Medical Library

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Psychology of a Mass Murderer*

Ralph S. Banay, M.D., New York, N. Y.

In November, 1950, in a small New Jersey community, a 26-year-old television repairman shot nine people, killing five and wounding four. He drove to his in-laws' house, where his estranged wife was residing with his two children, and attempted to see them, as he had done on previous occasions unsuccessfully. This day he took along some guns with the intention of frightening them into letting him see the children. When his father-in-law denied permission and the mother-in-law said, "Throw out that bum," he started shooting and killed the man and woman. Then he went across the street and shot more of his wife's relatives. Jumping into the car, he drove four miles to another distant relative, whom he killed.

The young man drove around for a while and, upon hearing the radio description of the incident, asked himself, "Could it be me?" Strangely enough, with four guns in his possession, he made an attempt to cut his wrist, but the wound was superficial. Shortly afterward, he spotted a police patrol car, stopped his own car, walked over to the policeman and said, "I guess I'm the man you are looking for."

It is not often that one meets a man who has committed mass murder. There are multiple homicides, committed in panic by psychotic people, usually in the wee hours of the morning when these emotionally deranged persons, haunted by their fears, delusions or hallucinations, and in a frenzy, usually kill off the members of their family and commit suicide. It might occur in cases of robbery, when a sudden surprise or an unexpected incident triggers senseless killing of a group of people under the fear of apprehension, or to avoid recognition, or to facilitate escape. In other instances it may

* Presented at the Annual Meeting of the American Academy of Forensic Sciences, February 23–25, 1956, Chicago, Illinois.

be done by gang executioners in the routine of murder for hire.

In our case, however, none of these circumstances was present. It was not the act of an overtly psychotic person, there was no robbery involved, he had not been drinking, nor was he pressed by others to perform this act. It meant traveling several miles from his home to the scene, which involved not one house but three. The people involved were not his immediate family, and the suicide attempt was a gesture only. Although it appeared a senseless act, certain selectivity was shown while he was walking through the house and lawns strewn with bodies. The rain of bullets was not aimed at his children. They escaped uninjured, and his wife received superficial wounds. What then were the factors in the personality or in the history of the individual that predisposed this man to such a volcanic eruption?

At birth he was a "blue baby" who was thought to be dead on delivery. Later he felt unwanted and unloved. His father, who was an undertaker, carried on his business in the basement of the small home where the family resided. As a boy of six or seven, with his slightly older brother, he would sneak down to the cellar where the bodies were stretched out and watch, trembling in fascinated horror, his father and uncle in the act of embalming. At school he was teased and tormented by his classmates because he was smaller than the others and because he stuttered. His books were snatched away; he was hit on the head, and nasty remarks were printed on the back of his coat. He did not fight back, because he was afraid he might "hurt someone," so the boys accused him of being a sissy.

In addition to his miseries at school, his home life was no better. He was often beaten by his father, and once to such an extent that he remained unconscious for six hours.

His difficulties increased in time, particularly when a teacher called upon him to read in front of the class. His stuttering made the other children snicker and burst out in loud laughter and epithets. On one occasion he felt so sick at heart he ran out of the classroom and stayed away from school and home for several days. For his chronic truancy he was transferred to a reform school, from which he soon graduated with a tendency to steal and burglarize homes. He

was then sent to prison for a couple of years. Upon release he was inducted into the army, where he soon found himself incarcerated for striking a superior officer. While in the service he married his first wife. After the war, when he returned to civilian life, he found his wife with a child from another man and divorced her.

He married his second wife while working on the farm of his future mother-in-law. They lived there for several years and had two children, but he felt exploited and urged his wife to break away from home and come with him to separate living quarters, where they could start a household of their own. He got another job as a television repairman with this end in view, but under the influence of the mother-in-law, the wife was reluctant to go with him. He departed alone, and made several attempts to take at least one of the children with him, but was unsuccessful. The wife and relatives refused to admit him to the home or allow him to see the children. He applied for legal aid from several attorneys, becoming impatient after weeks and months of delay, and tried to take matters into his own hands.

After working several months and living alone, he became moody and felt he was unable to work any more. He remained in his room in bed, or pacing the floor, up and down—up and down. Then the thought occurred to him that he would frighten his wife and relatives into giving him permission to see his children, so he took the four guns, put some of them in his pocket and drove to the in-laws' home. That is when the crime occurred. Upon his arrest, he insisted that he could not recall the events, but remembered hearing the report of the gun and smelling the smoke.

The psychiatric examinations shortly after the crime found the man not insane at the time of the examination or at the time of the commission of the crime. It was pointed out that he had been severely traumatized from early childhood. He was surrounded with the aura of death, he was unable to accept authority or the negation of his will. He was so anxiety-ridden that he felt that his children would forget about him and that his only significant emotional relationship would be gradually destroyed.

He was not sentenced to death, since a hysterical and vindictive demonstration by his wife in court swayed members of

the jury against her and in favor of the husband. He was sentenced to life imprisonment. The full picture of the personality has emerged more clearly now that five years have elapsed. Whereas five years ago, at the first psychiatric interview, he was rather humble, almost dazed and submissive, now he has turned out to be an embittered, inflexible and demanding despot who utilized all of his energies to become a cell-block attorney, studied law, found questionable technical points in the trial record and insisted on a new trial. His attorneys advised against this on the ground that four murders had been held in abeyance and he had received the life sentence for the murder of his mother-in-law, therefore he was jeopardizing his life with a possible death sentence. He discharged his attorneys one by one, accusing the court, the witnesses and even the medical examiners on false and unrealistic grounds. He himself was in the right and there was nothing for which he could be held responsible, because he had no malice in his heart and only meant to scare them. (He disregarded the fact that he had scared five of them to death.)

It was not a reaching out for help anymore, but a steel-like thrust against everyone involved in his case, a feeling of inadequacy implanted in his childhood, his unwantedness, the derision of his classmates, extreme punishment by his father which had grown to a torrent of hatred that he universalized. The man who wept five years ago now grieves that his victims died too quickly and did not suffer slow torture. If it could be done over, he would prefer to inflict painful execution. Regret or sorrow for his murders? None at all. Another example of the fallacy or popular belief in the myth that killers are haunted by a remorseful vision of their victims. "It was all an accident, but look what happened to me," was his quick explanatory response. His wounded feelings, the pain of his deprival and rejection by his wife and her family, these imponderable grievances outweighed in his scale the substantial fact that five persons died by his hand and four others were wounded. Time has unleashed further fury and aggression, now directed not only against his own but against the entire human family. He tried to rationalize his act and pointed out inconsistencies of society toward a person who

kills in war and gets medals for it, or in peace getting the electric chair. He failed to grasp the difference.

He hated his attorney, who saved him from the electric chair, and said that if he were free he would spend twenty years to have him disbarred. He said he did not recognize the validity of a law unless he approved it and stated that the action of judges was based on hypocrisy or personal animosity toward him. He would not admit he had committed an act of violence and refused to see he had taken the law into his hands.

"I lay down and think about these things, things I know they said, and try to piece them together. I try to reason it all out. I try to think how I got into the house. I actually don't know. I think I heard the shots. I said I think, I don't know. I think I smelled gun smoke. I wasn't sure, I don't know. I actually don't know."

He said he didn't remember driving from one place to another. He seemed surprised when asked whether he had achieved his purpose in seeing the children, and said if he had to do it over again he did not know what he would do. He complained that the law wanted to help him after the crime, but not before. He could not understand why society would not let him go free, since he felt he was not responsible for his act. "Everybody does irresponsible acts," he said, "not just stupid people, but smart people." One mistake and the man is gone. He didn't see that his mistake was a rather large one. He excused his act on the ground that he had to defend himself against injustice and did not see that he had overdone it. He refused to admit that his legal position was better than he had a right to expect under the circumstances.

Five years ago this man not only attempted to kill nine people, but symbolically he killed himself. This desire still prevails, and his effort to bring the case to a new trial is further evidence that he subconsciously is asking for the supreme punishment. The factors that operated in the personality five years ago were not fully recognizable clinically, but now the psychological profile indicates a fully developed paranoid constellation. A despotic, cold, aggressive personality, with searing hate toward everyone and lack of insight into the true nature and significance of his act, still probably

is not sufficient to declare him legally insane. But all this points up the fact that time will show, as in this man's case, that one who commits murder, especially multiple, even when it appears to be without mental disturbance, is seriously ill emotionally and bordering on some fundamental derangement.

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The Origin of the American Academy of Forensic Sciences*

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While medical jurisprudence was introduced in this country in the early eighteen hundreds its growth has been slow and sporadic. Several abortive attempts have been made to join scientists and others interested in the area of legal medicine. But in addition to medico-legal problems there have arisen several fields (such as criminalistics, questioned document examination, forensic psychiatry) which on occasion are intertwined with forensic pathology and toxicology (the pillars of forensic medicine) but on other occasions are concerned with their own field only. These various disciplines are interlocked, and methods, procedures, and information of one area should be available to all other groups. There is no fixed border for any forensic science, each has more than necessity to rely on the others. It would thus seem fitting that a central organization would be of extreme value in collating and disseminating the fundamentals of all forensic sciences.

The writer, fully cognizant of previous failures of such organizations, with the help of Dr. Israel Castellanos felt that a Pan-American Congress should and could be held. Unfortunately, because of monetary difficulties, it was not possible for scientists from the Latin-American countries to participate. The prime purposes of this Congress were the exchange of ideas and procedures, and the solidification of scientists into a functioning unit.

With the permission of the Board of Police Commissioners of St. Louis, Missouri, the writer called such a conference which was held in St. Louis on January 19, 20, and 21, 1948. Forty scientific reports were presented. The enthusiasm of

* First President, American Academy of Forensic Sciences; Director, Metropolitan Police Laboratory, St. Louis.

the meeting led to the writer being asked to organize a Steering Committee to consider the formation of a permanent organization. On October 18, 1948 this committee convened in New York City, and adopted the following resolution:

> "Be it resolved that this convocation of men interested in a better understanding and more perfect cooperation between law and science be recorded as desirous of joining with others to support a permanent organization, national in scope, for the following or similar purposes:
>
> "To promote the use of scientific methods and knowledge in the solution of legal problems and controversies; to develop and extend a better understanding of the application of legal doctrines to scientific professions; to improve professional qualifications of scientists engaged in the assistance of the courts and attorneys; and to plan, organize and administer meetings, publications, reports and other projects for the stimulation and advancement of the above purposes, and the standardization and improvement of scientific techniques, tests, and criteria."

To this end various committees were appointed, and the framework of the American Academy of Forensic Sciences (the name adopted) was constructed:

1. To raise the standards of investigative technic and the quality of testimony in court.
2. To engender the confidence and respect of the judiciary.
3. To promote the betterment of medical-legal testimony.
4. To create and foster confidence by the courts in scientific legal proof.
5. To raise the standards of reliability in investigation and testimony of scientists who perform this work.
6. To exchange information, and to encourage research and dissemination of knowledge in the various fields.
7. To encourage enlightened legislation.
8. To support all means available that justice be attained.
9. To improve participation of scientists in the attainment of justice.
10. To aid in the enactment of legislation to improve the administration of justice.
11. To encourage the application and use of science in the administration of justice.

ORIGIN OF ACADEMY OF FORENSIC SCIENCES

The first formal meeting was held in Chicago on January 26, 27, and 28, 1950, at Lincoln Hall, Northwestern University Law School. The writer was elected President, and Ralph F. Turner was elected Secretary-Treasurer. Dr. LeMoyne Snyder, as Chairman of the Committee on Constitution and By-Laws, presented his report, the name adopted being the American Academy of Forensic Sciences. The report was accepted by acclamation, and the American Academy of Forensic Sciences was now a fact, with much yet to be done, but with a knowledge that a group of scientists were ready to do whatever necessary to accomplish the aims of the Academy.

Thus, this organization has become an outstanding one. Its membership comprises the leading authorities on medical-legal matters in the United States. The initial thoughts, the hope and the organization of such a program which started in 1948 is now a reality. All who have attended the annual meetings have seen the growth of this organization and there is unanimity that the objectives of this organization are now a reality. There is much to be accomplished and a great deal of work to be done. The American Academy of Forensic Sciences is an established organization that can now be included among the scientific societies in this country.

The following have served as officers of the American Academy of Forensic Sciences:

President: R. B. H. Gradwohl, 1950–1951
S. A. Levinson, 1951–1952
R. N. Harger, 1952–1953
L. J. Regan,* 1953–1954
A. W. Freireich, 1954–1955
F. Inbau, 1955–1956
A. R. Moritz, 1956–1957
V. Satterfield, 1957–1958 (President Elect)

Secretary-Treasurer: Ralph Turner, 1950–1954
W. J. R. Camp, 1954–to date

* Deceased.

PLAN NOW TO ATTEND

the ANNUAL MEETING

of the

AMERICAN ACADEMY of FORENSIC SCIENCES

Chicago, Illinois—Drake Hotel

February 28, March 1–2, 1957

Determination of the Time of Death by Body Heat Loss*

Herbert P. Lyle, M.D., and Frank P. Cleveland, M.D., Cincinnati

During a period of years in which the authors have been Coroner and Pathologist for the Coroner, respectively, there have been numerous instances in which the knowledge of the exact time of death has been of great importance in the cases coming under the jurisdiction of their office. Ordinarily in Ohio the jurisdiction of the Coroner is primarily in deaths that occur from violence or under unusual or suspicious circumstances. Our own interest is mainly that of rendering assistance in the investigation of deaths due to criminal violence, so that investigating officers may direct their efforts into the proper channels. The establishment of the time when death occurred may be of considerable value in the settlement of claims for insurance and in the distribution of estates.

Recognizing that in the current armamentarium of the physician there are no means of determining the exact time of death, the authors planned a two-year program designed to measure the heat loss from the body over a minimum period of 24 hours, by recording the temperature simultaneously at six different sites of the human body. The specific aim of the research was to determine the rate of post-mortem cooling. Environmental conditions were standardized, and the covering of the body was made uniform. An attempt was made to control all factors affecting heat loss from the body in order to provide the standard conditions under which the studies were made. The majority of cases selected were those

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in which the precise time of death was known, and there was a minimal period between the time of death and the beginning of the observations. The body was placed in a constant temperature room as soon as possible and the standard conditions previously stated were established.[1] Most of the bodies chosen were those of persons whose deaths were due to natural causes. Some of the cases studied were persons found dead, and the time of death was not known.

Six sites were selected for recording of the heat loss. Thermocouples were placed as follows: (1) exposed skin of the forehead, (2) covered skin of the chest, (3) rectum, (4) liver, (5) brain, and (6) quadriceps muscle of the thigh. Thus using a variety of sites, an attempt was made to secure data that would be comparable and from which one could select a single site that would provide the most valid data from which the time-temperature relationships to time of death could be established.

Historical

Medicolegal investigators have two methods to assist them in determining the time of death. The *absolute or rate* method pertains to observations of various changes in the body, such as the appearance of post-mortem lividity, the onset and disappearance of rigor mortis, the rectal temperature changes and the state of putrefaction.

Various medicolegal investigators have used the following formula for estimation of the time of death:

$$\frac{\text{(Normal temperature) } 98.4^\circ\text{F.—rectal temperature}}{1.5} = \text{approximate number of hours} \qquad (8)$$

This formula is broadly based upon the assumption that under average conditions at room temperature, the clothed adult body will reach environmental temperature in about 20 to 30

[1] The temperature of the constant temperature room while constant during the observations of a particular case, was varied between cases. Sixty-nine cases were observed in the first year. For 24 of the cases the temperatures were in the 75 to 78 degree spread, for 22 of them 65 to 68 degree. The other 23 cases were at temperatures representing all of the temperatures between 62 and 78 degrees.

hours. In the experience of the authors these changes could not be correlated significantly for practical application, although they recognize that this was one of the methods whereby some idea might be gained as to when death did occur, but within a wide range of variability.

The other method for the determination of the time of death has been referred to as the *association method,* in which information, as to the time the person was last known to be alive, the condition of the surroundings of the body, such as the accumulation of papers and milk, the evidence of meals, and the growth or lack of growth of vegetation, is used. This latter method is more applicable to someone who has been dead for a longer period of time—days, weeks, months or even years—although in specific instances it might be applicable to much shorter periods of time.

A review of the literature pertaining to this subject has shown the inadequacy of currently available methods. All papers reviewed by the authors, in which heat loss was measured, were confined to observations of the temperature loss at a single site. There has been no prolonged study of the problem, using a large number of cases and recording the heat loss from multiple sites of the body. The observations contained in most reports, with but few exceptions, were made under environmental conditions entirely different from those in which the body was found.

In our approach to the problem, we first chose bodies whose time of death was known, and from a series of temperature recordings the normal rate of heat loss from the body under controlled conditions was determined. In addition, the same determinations as to the rate of heat loss were performed on bodies where the time of death was not known. We were not primarily concerned with establishing when death had occurred, but rather with establishing rates of heat loss under known conditions. Having established these "normal" rates for a controlled environment, we shall begin observations under conditions in which the influencing factors of heat loss are varied. We believe that the determination of the exact time of death can be accomplished only after the establishment of rates of heat loss from the body when conditions are controlled, as well as when conditions are variable.

Procedure

Bodies to be used in the research project were transported with as little delay as possible to the constant temperature room where the observations were made. The body was divested of its clothing, placed upon a wooden pallet on which there was a rubber sheet and then covered with a single layer of cotton sheet. The sheet covered the body from the shoulders to the feet and extended over the sides of the supporting structure. The head and neck remained uncovered. The head was supported by a rubber head rest. The thermocouples were inserted or applied in the areas previously designated. All of the thermocouples were specially constructed for the purpose indicated and were of the iron constantan type. The thermocouples for recording the temperature of the brain and muscles were constructed in standard 3-inch 19-gauge needles. The liver thermocouple was in a 4-inch 19-gauge needle. The thermocouple for recording rectal temperature was in a 1/4 x 3 inch water-tight gold-filled tube. One of the skin thermocouples was a U-shaped contact unit mounted in the tip of an aluminum handle. The other thermocouple for the skin consisted of two crossing wires mounted in a plastic ring to give uniform contact with the skin. The thermocouples were standardized and constructed for operation with a Leeds and Northrup 6 Point Model S Speedomax G Strip Chart Indicating Recorder. The temperature of each thermocouple was recorded on the chart through a multipoint indicator with a multicolor dot and number corresponding to the individual thermocouple. The temperature range of the recording chart is 30°–130° F. The temperature of each thermocouple was recorded every minute, so that during any one minute 6 temperatures were registered, representing all sites. The recording instrument operated with a chart speed of 10 inches per hour. During the period of observation of each body the room temperature and humidity were continuously recorded in most instances by a Casella thermohygrograph.

The length of each body was measured by a rigid telescoping measuring device. During the early period of the investigation the body weight was estimated, but now bodies are weighed accurately upon a springless overhead suspension scale. The body length and weight were used to compute the surface area.

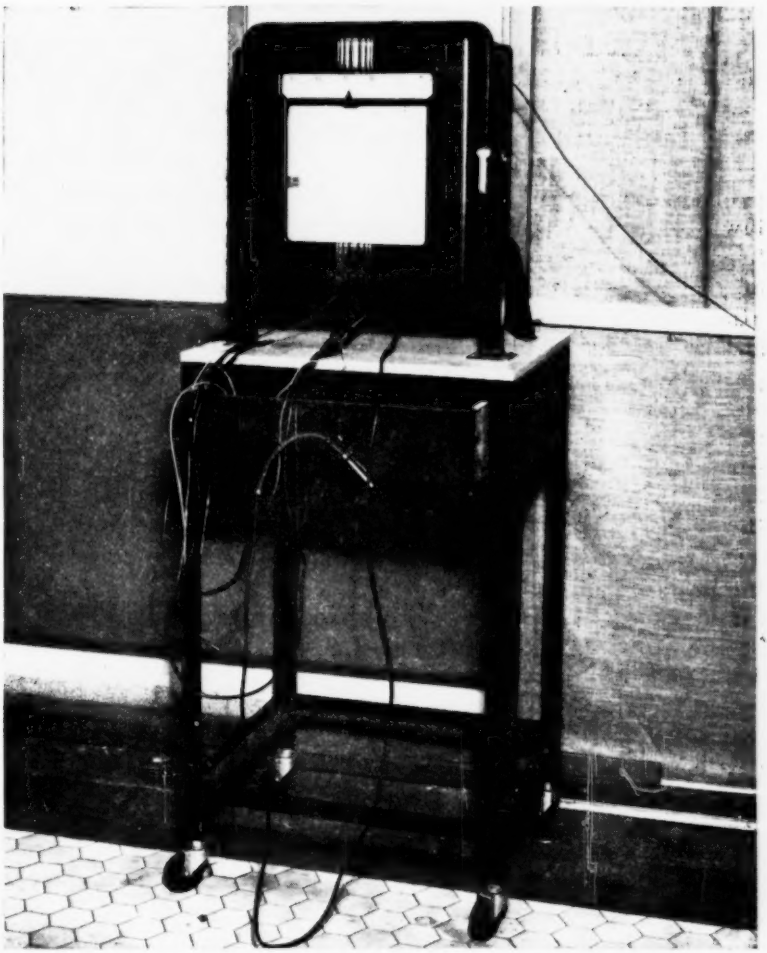


Fig. A—Leeds and Northrup 6 Point Model S Speedomax G Strip Chart Indicating Recorder.

In concurrence with the temperature observations, the general condition and changes in the body, such as post-mortem lividity, rigor mortis and onset of putrefaction were noted, as well as the external appearance of the body.

Results

During the initial 8 months of the investigation, time-temperature recordings were obtained on 56 cases. This dis-

cussion pertains to some of the results from these cases. The average period of observation was approximately 19 hours, the majority of cases being observed over a minimum period of 24 hours and, in certain instances, the time of observation was extended beyond the 24-hour period.

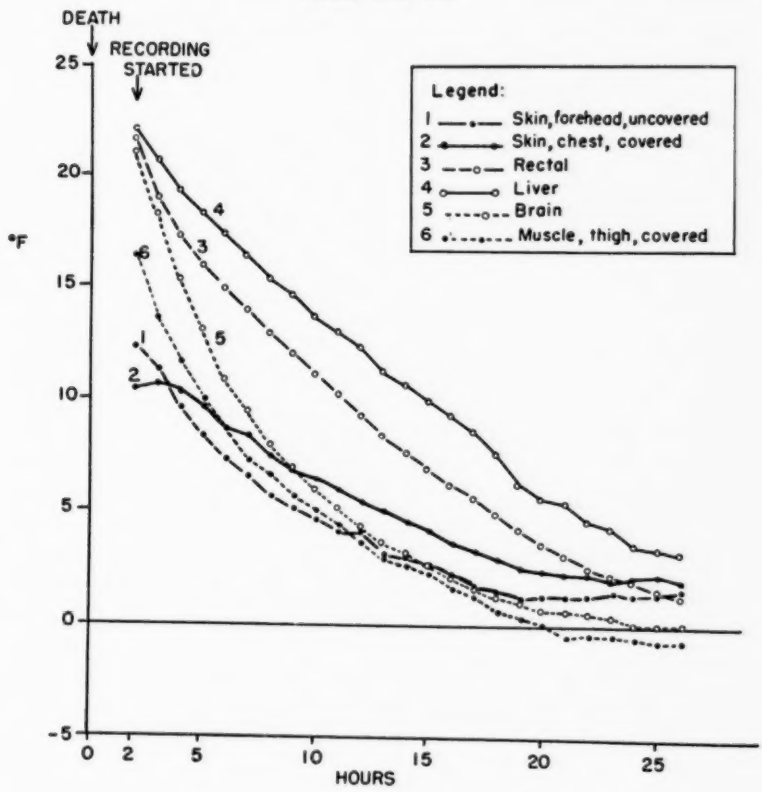
Time-temperature charts were made for each case. After preliminary graph construction and reference to Newton's law of cooling, it was decided to construct the graphs on the basis of the differential temperature, that is, the temperature of the body as it differed from the environmental temperature. In all cases the rate of heat loss from the six different sites recorded was different. When all of the cases were compared as to heat loss from a given site, it was found that there was general agreement between the curves, and from the data it was possible to determine the relative range of variability for each of the different sites. In general, the loss of heat from the brain followed the same pattern in every case. Also, the range of variability was generally less in the brain and became progressively more marked in the following order: rectum, liver, muscle and skin. Preliminary observations have indicated that the most reliable single site for recording the temperature was the brain and the least reliable was the skin. The range of variability in the rectal temperature was rather marked. The factors that influence the rectal temperature were believed to be bacterial action within the rectum and related structures and putrefactive changes.

Figure 1 contains the differential temperature curve representing the six sites over a 24-hour period from a specific case. The observations were begun 2 hours after death had occurred, at which time the temperature of the exposed skin and of the covered skin differed by 1⅚° F. The liver temperature was highest. The rectal was ⅓° F. lower and the brain was 1° F. lower. The temperature of the thigh muscle was 5⅔° F. lower than the liver. The figure indicates the relative rate of heat loss at the different sites, and shows the similarity in the liver and rectal curves, with a somewhat more rapid fall of the rectal temperature in the early period. Heat loss from the brain is most rapid in the early hours of observations and in the latter hours has a more gradual fall. There is close similarity between the heat loss in the thigh muscle and that of the exposed skin, the covered skin showing a less

rapid loss of heat through the entire period and remaining at a somewhat higher level at the end of the period of observation. In general, the pattern of the curves as shown in Figure 1 is typical of those observed in the other cases.[2]

FIGURE 1

DIFFERENTIAL TEMPERATURE CURVES, 24 hour period, 6 sites
Case No. 53



[2] Bodies which exhibited temperatures below room temperature, were noted most frequently in the uncovered skin, then the muscle, brain, rectum, and liver in that order.

Figures 2 and 3, for purposes of showing the character of each curve, each contain the curves of three sites only, to portray the general pattern of heat loss.

FIGURE 2

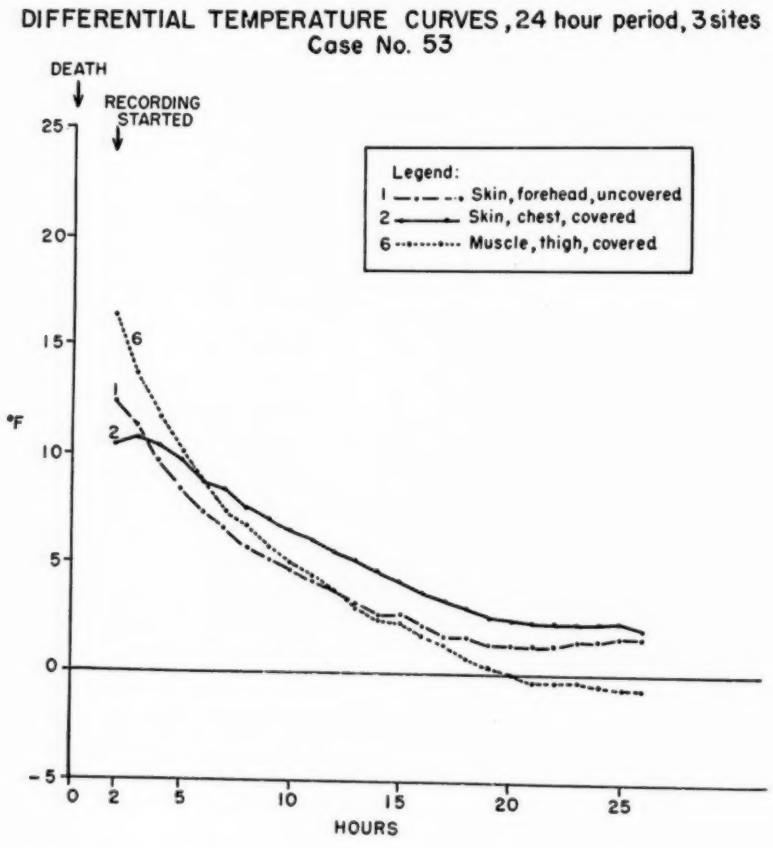


FIGURE 3

DIFFERENTIAL TEMPERATURE CURVES, 24 hour period, 3 sites
Case No. 53

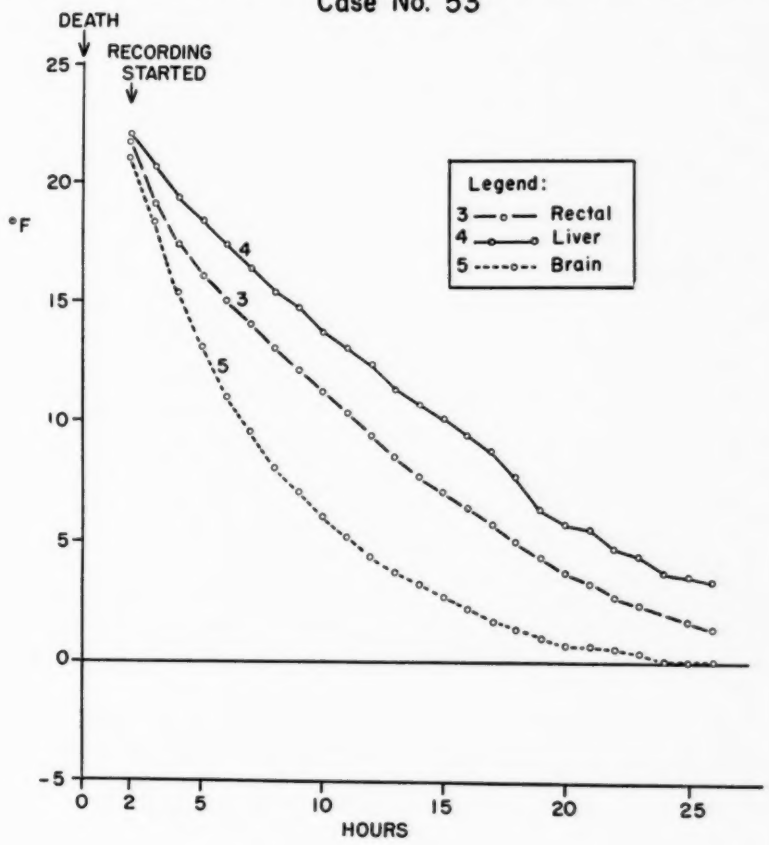
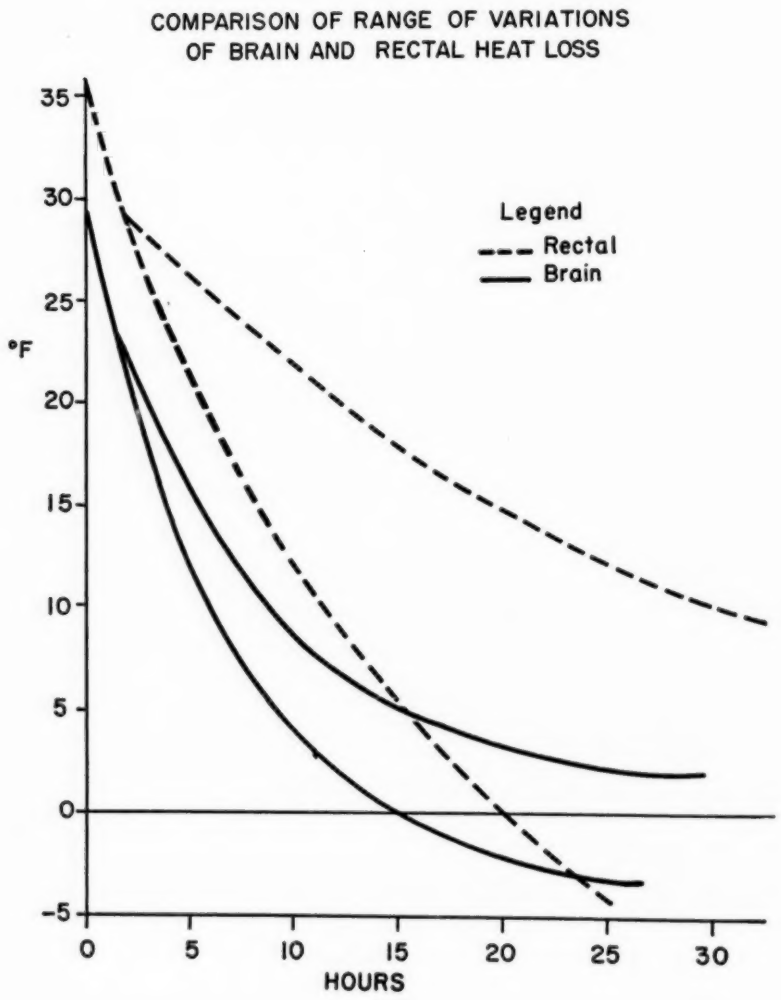


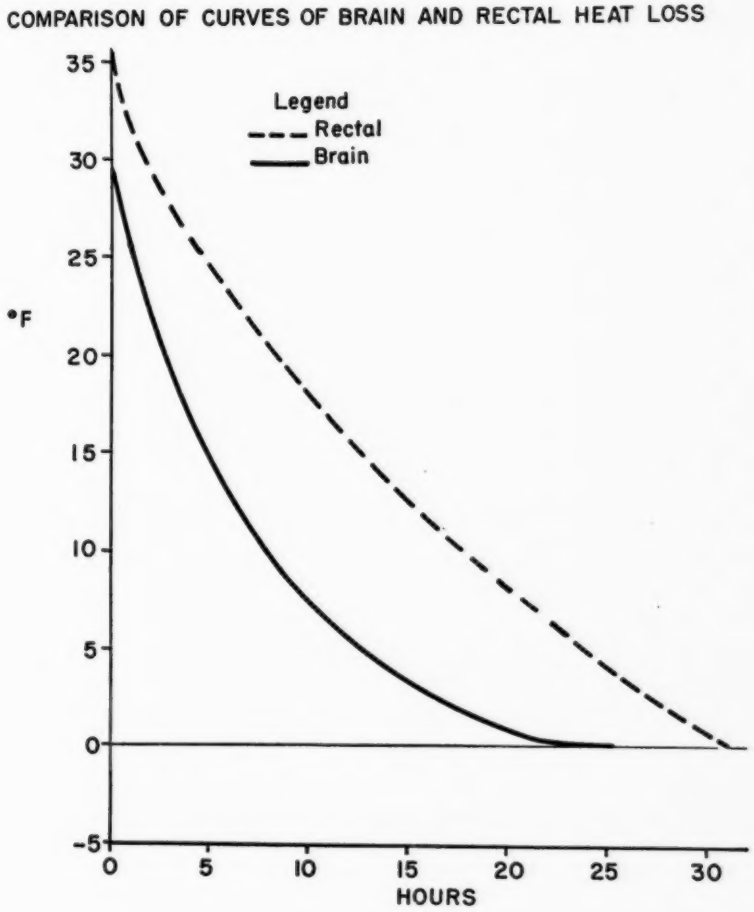
Figure 4 is a comparison of the range of variation that was noted in the rectal and brain temperatures. As is indicated in the graph, during the early hours of observation the range of variations is considerably less, whereas during the terminal hours there is an extremely wide range, which is less marked in the brain temperatures. In computing the average rate of

FIGURE 4



heat loss of either the brain or the rectum, the curves illustrated in Figure 5 are derived.

FIGURE 5



Conclusions

On the basis of the observations contained in this report, the following impressions resulted:

(1) The rate of heat loss from the body by radiation varies considerably according to the sites selected for recording.
(2) The rate of heat loss from the body is dependent to a great extent upon the difference in temperature between the environment and the body.
(3) The variabilities of body structure, physiological activity, putrefaction and external insulation are important factors affecting the rate of heat loss. These factors have less effect upon heat loss from the brain than from the other sites studied.
(4) The time of death cannot be determined by measurement of heat loss within satisfactory limits when death has occurred more than 24 hours before the observations are begun or when there is only a few degrees' difference between the environmental and body temperatures.

Preliminary statistical examination of the results obtained on the 56 cases has resulted in certain suggestions for the further conduct of the investigation. No attempt will be made to draw conclusions until a greater number of cases has been examined and subjected to statistical analysis.

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Differential Thermal Analysis: Its Application to the Study of Mineral Evidence in Scientific Crime Detection*

Roy H. Jevons, Washington, D. C.

The FBI Laboratory has conducted research in various fields of science in search of practical applications to investigative problems. One research project which has contributed results of significant value is the subject of this paper.

Many chemical and mineral substances will exhibit thermal changes when heated. Decomposition, oxidation, rearrangement of the molecular structure, dehydration and other phenomena will cause the substance to give off heat or absorb heat (exothermic and endothermic reactions). A measure of these thermal changes offers data for the identification and study of the substance under consideration.

A kaolinite type of clay, for example, when heated to about 600° C. will absorb heat during the expulsion of molecular water from its crystal lattice. When heated still further to about 980° C., an exothermic reaction is experienced during which the clay molecule breaks down to form several new substances. Other types of clay will exhibit similar phenomena, but the thermal reactions will occur at different temperatures and with different magnitudes.

For precise quantitative measurement of thermal reactions, there is no substitute for the laborious calorimetric method. However, a method for qualitative and semiquantitative analyses known as differential thermal analysis has been

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developed over a period of years to a point where it is standard procedure in many laboratories.

With differential thermal analysis, the temperature difference between the sample and an inert compound, such as fused alumina (Al_2O_3), is plotted against sample temperature over a range of 1000° C. or more. The resulting curve will show the number of reactions, the nature of each reaction, the amount of heat evolved or absorbed, and the temperatures at which the reactions take place.

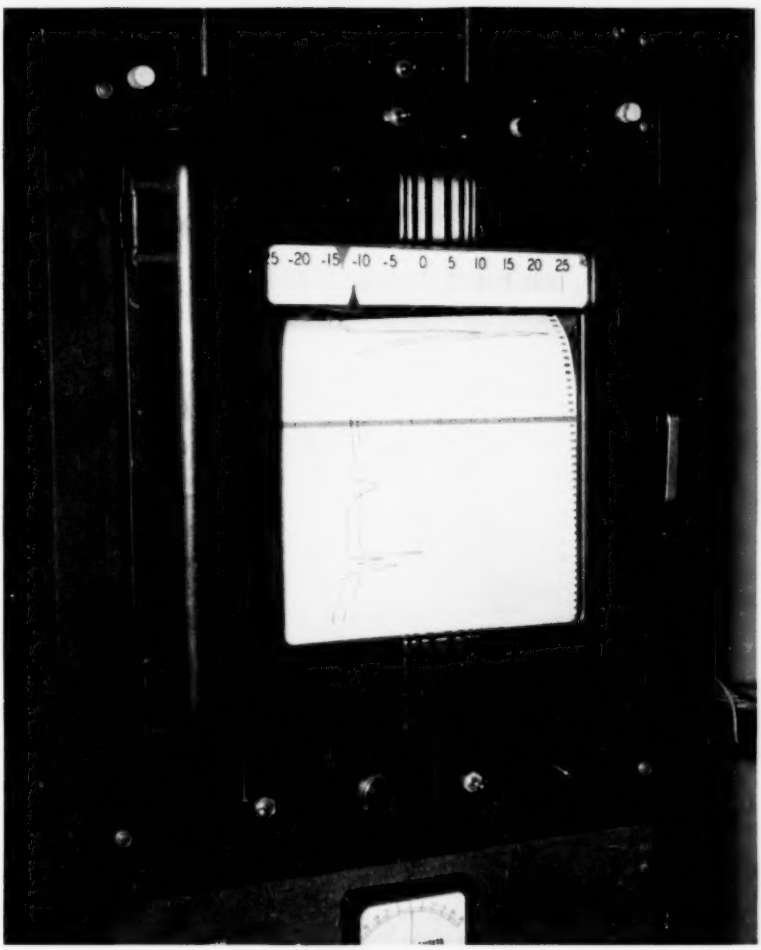
The temperature difference is obtained with the use of double terminal thermocouples (differential thermocouples). One terminal is inserted in the sample and the other in the alumina. As long as both terminals experience the same temperature, no current is produced by the thermocouple and the recording instrument produces essentially a straight line. A thermal reaction occurring in the sample, however, will cause a temperature difference between the two terminals. A current will flow as a result of this temperature difference in a direction reflecting the nature of the reaction. The current is amplified and recorded as a peak by the recording instrument. (Figure 1.)

The differential thermal analyzer constructed in the FBI Laboratory incorporates an automatic furnace controller and recorder for good reproducible curves. Basically, the analyzer consists of the furnace assembly, the sample holder and thermocouple assembly, the furnace heat controller, and the preamplifiers and recorder. (Figure 2.)

The method of thermal analysis has been applied successfully in the FBI Laboratory to the study of clays, soils, plasters, cements, safe insulations and, experimentally, to the study of lubricating oils.

Figure 3 shows thermograms typical of several of the clay minerals. Beginning at the top of the column, the curves are identified as those of the minerals kaolinite, halloysite, dickite, montmorillonite, another montmorillonite and nontronite. From a study of these curves one can see significant differences between them. Most of these were made with well-crystallized clay minerals of uniform size. A clay in a soil, however, may be diluted, partially decomposed and have crystals of irregular size. These properties and the presence of mineral and organic impurities will affect the thermal

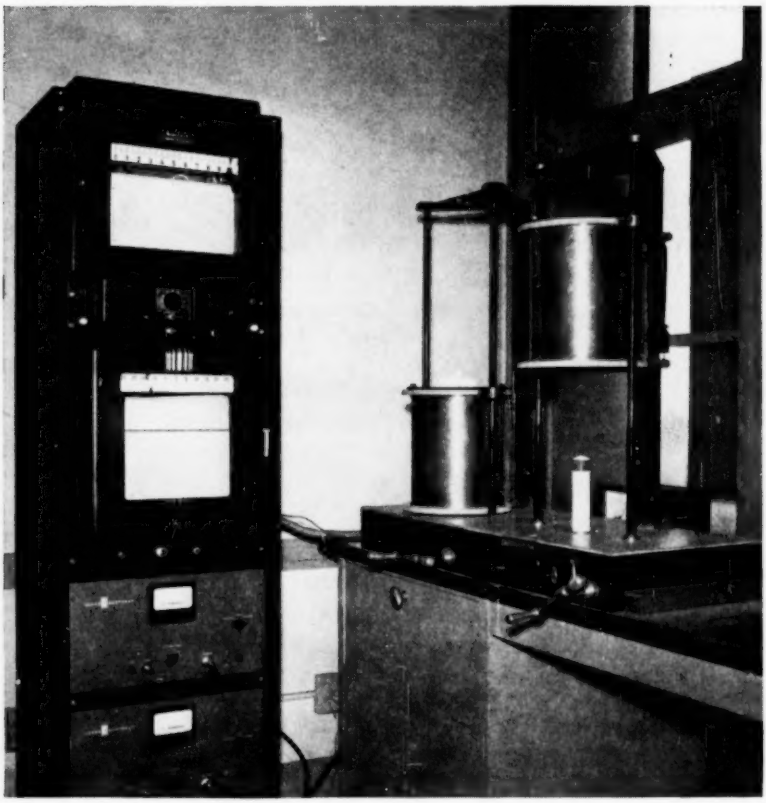
FIGURE 1



curve and alter its appearance. This alteration from the standard is useful in the comparison of soil samples in criminal cases.

In these cases, the problem is to determine whether or not a soil, possibly from a suspect's shoes, could be from the scene of the crime. It is necessary in this type of examination to

FIGURE 2

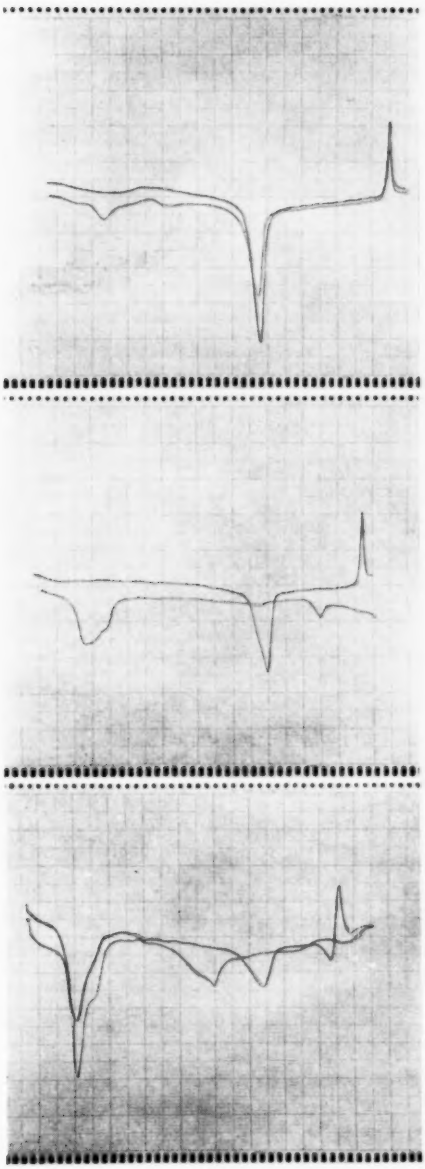


study samples known to be from the crime scene and compare them with the questioned material.

During the investigation of a double murder case, a shovel was found in the possession of a suspect. The shovel had a quantity of soil on the blade and what appeared to be blood on the handle. It was believed to have been used to sever the head of one victim and to dig the shallow graves in which the bodies were found.

Numerous samples of soil were collected from the graves, from the suspect's property and other sources from which the soil on the shovel may have originated. These samples

FIGURE 3



and the shovel were submitted to the FBI Laboratory for examination.

The examination of the deposit on the blade revealed five distinct soils, four of which were later found to be present in one of the graves. The four soils had characteristic thermograms not exhibited by any of the other samples.

Plasters, mortars, safe insulations and other cement products are sometimes found on tools belonging to burglars who have used them to break into buildings and safes. These substances are readily analyzed by the differential thermal method.

The average gauging plaster is made from a mixture of plaster of Paris, lime, water and minor amounts of other substances to adjust the setting properties. Plaster of Paris is a calcium sulfate hemihydrate which produces a thermogram like that illustrated in Figure 4, curve (b). Curve (a) is a thermogram of the mineral gypsum, from which plaster of Paris is made.

Curves (c) and (d) of Figure 4 show a comparison of two evidence specimens of plaster. Curve (c) reflects the presence of calcium sulfate, calcium hydroxide and calcium carbonate. The presence of calcium hydroxide shows incomplete carbonation. Curve (d) reflects in addition the presence of magnesium hydroxide. Only a trace of magnesium hydroxide is indicated in the first specimen.

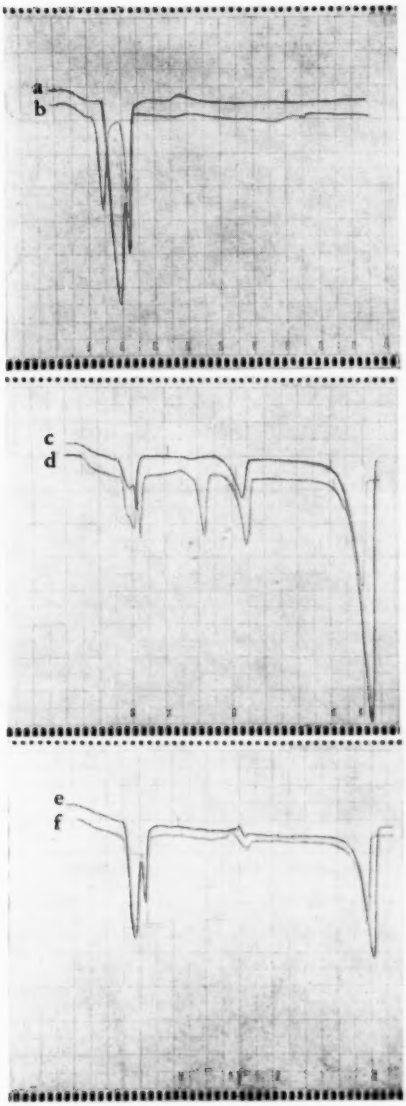
Curves (e) and (f) of Figure 4 illustrate two similar plaster specimens with slightly differing peaks at about 475° C. This difference is probably a result of the conditions under which the two specimens "set up."

The fireproofing material incorporated in the walls of safes and known as safe insulation is excellent evidence in cases of safe burglary. Many of the safe manufacturers use a cement product which is peculiar to their trade and which can be identified, in most instances, as the product of one or more of the safe companies.

Conclusions

Differential thermal analysis offers a convenient method for the identification of safe insulation and for distinguishing between insulations from different makes of safes.

FIGURE 4



A number of other avenues have been explored with this method of analysis in the FBI Laboratory, but considerable additional research remains to be done before the full value of differential thermal analysis is realized in the field of scientific crime detection.

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Questioned Documents and Other Problems in Postal Law Violations *

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In 1775, an illustrious American, Benjamin Franklin, became our first Postmaster General under authority of the Continental Congress. Franklin advocated the principles and instituted the basic procedures which have become traditional in providing for the secure and efficient handling of the mails. Since Franklin's time the full power of the Government has been pledged, and the Post Office Department has been dedicated to upholding the principle of the sanctity of the mails. Through the years the Department has strengthened and extended the application of this principle to shield the users of the mails against harmful and illegal influences, including every form of swindle or fraud.

The average American may know little of the workings of his post office, but he does know that an ordinary United States postage stamp guarantees his letter against theft, destruction, or even mere snooping. He knows that his mail is inviolate. He also knows that those who would molest his mail or attempt to harm or defraud him through the instrumentality of the mails are relentlessly pursued and brought to justice.

Protection of the mails is a first consideration in the traditions of the postal service. That this is no small task may be better understood when the volume of the mails and the extent of postal operations are considered. During the fiscal

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year 1952 nearly 50 billion pieces of mail were distributed through more than 43,000 post offices in every corner of the United States and the territories. This great stream of mail continues to grow. It is in constant circulation, passing through the hands of some 500,000 postal and auxiliary employees, and is transmitted to its destination by every conceivable mode of transport.

The mails carry the nation's social and business correspondence; its publications and advertising; a substantial quantity of the merchandise in transit; and the actual financial instruments such as checks, cash, and money orders, without which our modern economic structure could not exist. Some 800 million special service transactions (money orders, postal savings, C. O. D's, etc.) were handled by post offices in the fiscal year 1952. Approximately 375 million postal money orders, aggregating nearly 6 billion dollars in value, were issued during the year. In operations of such complexity and magnitude it is inevitable that opportunities and temptations for the commission of depredations on the mails will occur.

The task of safeguarding the mails is assigned to the Postal Inspection Service, the oldest investigative agency of the Federal Government. A mobile field force of 840 postal inspectors, co-ordinated by the Chief Inspector, is charged with the major responsibility of investigating all violations of the postal laws and of aiding in the prosecution of criminal offenses related thereto. The inspectors examine methods, systems, and accounts throughout the postal service. In addition, they have the function of acting as advisers and management assistants to the Postmaster General and his bureau heads, and of supplying specialized information and technical data to meet certain problems.

During a typical year the inspectors completed 145,000 investigations, more than half of which concerned criminal cases. These investigations resulted in the apprehension of 5,487 offenders and in the conviction of 4,857. A partial list of the crimes for which arrests were made would include burglary, holdup, and robbery; fraudulent use of the mails; mailing of lottery schemes and devices; mailing of obscene, threatening, scurrilous, and defamatory matter; mailing of poisons and explosives; extortion; embezzlement; and the forgery of money orders, postal savings certificates, and

other government paper. These violations of the postal laws are described in Title 18 of the United States Code, which also prescribes the pertinent punishments.

Congress and the Supreme Court have exercised their powers in combating mail frauds and depredations. For example, Congress has enacted that any person or company which obtains money or property by false or fraudulent pretenses or promises may be barred from the use of the mails entirely. This is the particularly effective "Fraud Order," under which all mail directed to such a person or company is stamped "Fraudulent," and returned to the sender. Federal legislation was recently passed to amend Section 1708, Title 18, United States Code, making the theft of mail a felony, regardless of value. The Supreme Court, for example, has held that the protection afforded letters does not cease when a carrier delivers mail into a private mail box, but continues as long as the letters remain in the box.

It will be evident that the postal crimes referred to above involve documents of every character; letters, accounts, receipts, negotiable paper, etc. A question as to the identity of the author, signer, or indorser of a particular document may arise in any case. The cases therefore frequently generate problems and inquiries which come within the scope of the examiner of questioned documents.

The Inspection Service has recognized the value of, and the need for, modern scientific crime detection techniques in carrying on its investigations. In order to expedite the solving of cases requiring scientific skills, five identification laboratories are maintained at strategic centers of the Service: Washington, D. C.; Cincinnati, Ohio; Saint Louis, Missouri; Chicago, Illinois; and San Francisco, California. Each laboratory is organized and equipped as an independent unit to handle the cases occurring in a geographical territory. The Chicago laboratory which I represent serves a six-state area: Illinois, Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.

The laboratories operate under the Division of Mail Fraud Investigations of the Chief Inspector's Bureau. They are staffed by document examiners and their technical and clerical assistants. Our analyses and testimony are available in all cases where the inspectors require assistance to develop evidence, eliminate numerous suspects rapidly, determine fi-

nancial responsibility, obtain admissions or confessions, and to facilitate the prosecution of postal law violators.

Although our major effort is in the field of questioned document examination, the laboratories also conduct examinations and comparisons in related fields. We provide liaison with other forensic laboratories and furnish miscellaneous photographic service to the inspectors. In addition to these routine services, the laboratories undertake research in various phases of document examination, and engage in the training of prospective analysts. Recent research studies made by the laboratories include such projects as ink chromatography; infrared, ultraviolet, color, and stereoscopic photography in relation to the examination of questioned documents; typewriter identification; and the study of handwriting systems and handwriting classifications.

Approximately 1,800 cases, covering some 42,000 specimens, are examined in the laboratories during a typical year. These cases originate either in complaints or allegations made by the users of the mails, or as requests for the examination of exhibits submitted by inspectors and departmental bureaus in matters under investigation. Certain cases involving cooperation with other law enforcement agencies outside the Post Office Department are also referred to the Inspection Service laboratories.

The cases handled by the Chicago laboratory may be grouped in five general categories:

1. Cases involving the wrong payment, forgery, altering counterfeiting, and other mistreatment of money orders, postal savings certificates, and other government paper.
2. Cases involving the forgery, altering, and passing of checks stolen from private mailboxes.
3. Cases involving the mailing of prohibited matter.
4. Cases involving depredations on the mails.
5. Miscellaneous cases in which technical assistance is required.

The first two categories listed include a considerable volume of our normal work. This may be characterized principally as the examination of "single-signature" forgery cases. The millions of checks mailed annually, combined with the comparative ease with which forged paper may be negotiated, offer a lucrative field for house letter-box thieves and similar criminals. A few significant points may be noted concerning

the document problems associated with this type of postal crime:

Thefts from private mail receptacles and the related forgeries have increased markedly during the past two years. More than 2,200 offenders were arrested for such thefts in 1952, and more than 200 were apprehended for forgery or other criminal acts in these categories. The current widespread use of narcotics is a serious problem to the Inspection Service in that many addicts steal checks from private mailboxes in order to sustain their vices. The checks are cashed on forged indorsements. In New York City alone, addicts represented approximately 50% of all persons arrested in the fiscal year 1951.

Forged, altered, and even counterfeited identification credentials are widely used by persons illegally passing money orders and checks. Increasing numbers of these false credentials are received by the laboratories for processing to determine the true or original data thereon. Some success in tracing the offenders through the restored data on altered identification cards has been achieved through ultraviolet photography and chemical treatment, notably by fuming with sulfocyanic acid vapor.

A recent case in the Chicago division concerned the successful cashing, for a second time, of numerous commercial checks which had been legitimately paid once before. The modus operandi involved stealing the canceled checks while en route to the clearing house bank, eradicating the rubber stamp impressions of the original paying banks, and re-cashing the same checks with the indorsements of the true payees intact. In a few instances a forged second indorsement was added. These manipulations were facilitated by the fact that the bank stamps were impressed with water-soluble inks on checks having plain white paper backs. Photography by the ultraviolet fluorescence process revealed the method and extent of chemical treatment, although it was impossible to completely restore the eradicated data in each instance. Two women, later apprehended in this case, corroborated the laboratory's findings that the original bank stamps had been bleached with ordinary two-solution ink eradicator.

The development of latent finger impressions on all types of documents is a subject of continuing interest and study to the Inspection Service laboratories. Some success has been

achieved in developing fingerprints on stolen and forged paper. The "Invisible Thumbprint Indorsement" plan used by some cashing agencies has aided in the identification and prosecution of check-thieves.

The prohibited-matter category includes the full range of "poison-pen" letters, extortionate, anonymous, obscene, scurrilous, threatening, and defamatory writings. Problems encountered in such cases involve the elimination of numerous suspects, often juveniles; the identification of typewritings and typewriters; the restoration of obliterations and erasures, and the detailed study of handwriting systems and personal writing habits. A limiting factor in certain of these cases is our inability to obtain sufficient or suitable known handwritings upon which to base a thorough comparative analysis.

Also included in the prohibited-matter category are the mailing of poisons, narcotics, explosives and bombs, and other injurious items. While many of these cases may be considered as having only nuisance effects, a substantial proportion involve deadly intent upon the part of the mailers, and present a real source of danger to postal personnel as well as to the addressees. A strand of twine; a half-eaten morsel of poisoned cake or candy; a few fragments of writing; a grain of explosive, and a damaged postmark are perhaps the only clues in these attempts at "murder by mail." Painstaking analyses by the laboratories, coupled with persistent and exhaustive investigation in the field, have solved the greater number of these crimes. Our Washington and Cincinnati laboratories has accomplished noteworthy results in this respect in recent years.

Latent finger impressions, mentioned in a preceding section, assume increased importance in mail depredation cases. Considerable work is being done by the laboratories with iodine, silver nitrate, and other special chemicals in developing prints on rifled mail matter. Document problems in this category include the examination of letters and parcels for tampering, opening, and resealing. A critical question frequently raised concerns the point, during the handling of the mail, at which an alleged tampering occurred. This involves microscopic study of the paper fibers, analysis of the adhesive matter, and, in the case of registered letters, an evaluation of the

significant stamp impressions across the flaps of the envelopes. Holdup and burglary cases, also in this category, entail tool-mark comparisons; rubber heel, tire and shoe impressions; and paint, soil, and related analyses.

Our final category covers all questioned document cases referred to the laboratory which have not been mentioned before. Included are cases concerning the removal of cancellations on postage and postage-due stamps; the re-use of such stamps, embezzlements, fraudulent or falsified accounts within the postal service, and other matters, possibly non-criminal in character, which require the attention of the document examiner. As an example of the latter class, some years ago, the Dead Letter Branch of the Chicago Post Office submitted an old document to the laboratory. This paper was a British Army Discharge certificate dated in 1775. It had been inclosed in an old family Bible which was separated from its wrapper and address during mail-handling. The problem was to restore the document to its rightful owner. Investigation and research disclosed that the discharge, written with quill-pen in archaic English script, had been issued to a Hessian soldier, a member of the so-called "Royal American Regiment." This man was discharged in Jamaica after nearly nine years of military service, and emigrated to the "colonies." At some later period in his life he Anglicized his German name. His descendants settled in the Middle West. Through the discharge and other papers it was possible to trace his collateral descendants and restore the documents to the addressee.

Summary

Certain problems in the field of questioned document examination as related to violations of the postal laws of the United States are presented. The development of policy with regard to the paramount principle of the sanctity of the mails is briefly traced.

The scale of postal operations, and the framework and function of the Postal Inspection Service are outlined. The organization, methods, technical work, and research conducted by the five Postal Inspection Service forensic laboratories are considered in some detail. A discussion of the

various types of questioned document cases encountered in the Inspection Service laboratories has been presented.

The Post Office Department and its investigative agency, the Postal Inspection Service, supported by the full power of the Government, engage in such activities as will sustain the confidence of the people of the United States in the safest and most efficient postal service that can be provided.

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EDITORIAL

A Century of Progress: The Durham Case

In the case of Durham vs. the United States (214 F. 2nd 862), decided July 1, 1954 by the Court of Appeals for the District of Columbia, Judge Bazelon in an outspoken manner rejected the long established "right and wrong" and the "irresistible impulse" tests of insanity in criminal cases and affirmed that an "accused is not criminally responsible if his unlawful act was the product of mental disease or mental defect." (214 F. 2nd 874–875.) Thus legal tradition of 111 years has been broken. M'Naghten in 1843 was acquitted by reason of insanity following an attempt on the life of the Prime Minister of England, which resulted in the death of a secretary. The jury at that time found the defendant not guilty in that he was "not sensible" that he knew "he was doing a wrong or wicked act." For a century psychiatrists have been rigidly held to an evaluation of the ability of an accused to recognize the right from the wrong, although medical science, and forensic psychiatry in particular, has transcended its original philosophical roots and become established as a biologically oriented science. The Durham case recognizes the presence of mental disease and of mental defect and permits the psychiatrist to speak to the jury as a physician concerned with the total personality of the accused. The bewildering metaphysical schizophrenia of the courtroom, in which the personality of the accused is shredded into rational and irrational components, need no longer prove the despair of the psychiatric witness and the weapons of the lawyer. The psychiatrist is no longer forced to express against his will a moral judgment of guilty or not guilty. The Durham rule unfetters the psychiatrist from the rigid legal formulation of the

past and permits the psychiatry of the clinic to be expressed in the courtroom, a memorable step in the history of forensic psychiatry.

M. I. TUCHLER, M.D.

Annual Meeting

AMERICAN ACADEMY OF FORENSIC SCIENCES

Drake Hotel, Chicago, Illinois, February 28, March 1–2, 1957

General Sessions—Section Meetings

Pathology—Toxicology—Immunology—Psychiatry—Law—

Questioned Documents—Police Sciences

Christian Science and Longevity*

Gale E. Wilson, B.S., M.D., Seattle, Washington

Not infrequently one hears the statement "Peace of mind begets a longer life." Or, "Women live longer than men," and "Christian Scientists live longer than other people." Many persons, including medical men, believe that individuals with relative tranquility of mind have less heart trouble, or less kidney trouble than those in a state of greater tension, and consequently live longer.

Like most states, Washington statutes provide that "The jurisdiction of bodies of all deceased persons who come to their death suddenly without medical attendance * * * is hereby vested in the county coroner." (R.C.W. 68.08.010.) Also, in the Session Laws of 1953 a paragraph was amended to read: "If the death occurred without medical attendance, the funeral director or person in charge of interment shall notify the coroner * * *. In case of any death without medical attendance in which there is no suspicion of death from unlawful or unnatural causes * * * the coroner * * * shall complete and sign the certification, noting upon the certificate that no physician was in attendance at the time of death, and noting the cause of death without the holding of an inquest or performing an autopsy or post-mortem, but from statements of relatives, persons in attendance during the last sickness, persons present at the time of death or other persons having adequate knowledge of the facts." (R.C.W. 70.58.180.)

Under the authority of the above acts, during the past 21 years I have, as autopsy surgeon for the King County Coroner, examined, autopsied, or certificated the deaths of slightly more than one thousand individuals who expired without a physician in attendance because of their belief in Christian

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Science. Many of these cases have been autopsied, but the tendency is decreasing somewhat under the above quoted 1953 law, with the probable cause of death being given and then followed by the notation "Died without medical attendance—C.S." (C.S.—Christian Scientist.)

During these past years I had gained the impression that the age of the Christian Scientists was rather greater than that of the public at large, and it is with that thought in mind I began the present study. Conversations with coroners and medical examiners from other parts of the country have indicated that they had never given it much thought, but that it "seems like they live longer." There is no intention, direct or inferred, to in any way enter into a discussion of the theory or practice of Christian Science, but merely to present a completely impartial marshalling of the facts pertaining to deaths in this particular group.

There are perhaps three questions that might be asked: 1. What is Christian Science? 2. How many people belong to the Church? 3. When, and of what, do they die?

To answer the first question we must turn to the book "Science and Health with Key to the Scriptures," by Mary Baker Eddy, the Discoverer and Founder of the Church of Christ, Scientist. The First Church of Christ, Scientist, often called the "Mother Church," was founded September 23, 1892 in Boston, Massachusetts, and by 1955 there was one branch church in nearly every city of over 50,000 population in the United States.

In her book, "Science and Health with Key to the Scriptures," Mrs. Eddy outlines the basis of the belief with these words: "I have set forth Christian Science and its application to the treatment of disease just as I have discovered them. I have demonstrated through Mind the effects of Truth on the health, longevity, and morals of men; and I have found nothing in ancient or in modern systems on which to found my own, except the teachings and demonstrations of our great Master and the lives of prophets and apostles. The Bible has been my only authority. I have had no other guide in 'the straight and narrow way' of Truth." (Page 126.)

Also, in relation to longevity, Mrs. Eddy continues: "The measurement of life by solar years robs youth and gives ugliness to age. The radiant sun of virtue and truth coexists with

being. Manhood is its eternal noon, undimmed by a declining sun. As the physical and material, the transient sense of beauty fades, the radiance of Spirit should dawn upon the enraptured sense with bright and imperishable glories.

"Never record ages. Chronological data are no part of the vast forever. Time-tables of birth and death are so many conspiracies against manhood and womanhood. Except for the error of measuring and limiting all that is good and beautiful, man would enjoy more than three-score years and ten and still maintain his vigor, freshness, and promise. Man governed by immortal Mind, is always beautiful and grand. Each succeeding year unfolds wisdom, beauty, and holiness." (Page 246.)

Further: "Being is holiness, harmony, immortality. It is already proved that a knowledge of this, even in small degree, will uplift the physical and moral standards of mortals, will increase longevity, will purify and elevate character. Thus progress will finally destroy all error, and bring immortality to light." (Page 492.)

Longevity is also decreed in the following quotation from "Science and Health": "Peals that should startle the slumbering thought from its erroneous dream are partially unheeded; but the last trump has not sounded, or this would not be so. Marvels, calamities, and sin will much more abound as truth urges upon mortals its resisted claims; but the awful daring of sin destroys sin, and foreshadows the triumph of Truth. God will overturn, until 'He come whose right it is.' Longevity is increasing and the power of sin diminishing, for the world feels the alterative effect of truth through every pore." (Page 223.) Along this same line on page 167 of the same book we find: "Our proportionate admission of the claims of good or of evil determines the harmony of our existence,—our health, our longevity, and our Christianity."

With the hope of the future, Mrs. Eddy has written: "I have never supposed the world would immediately witness the full fruitage of Christian Science, or that sin, disease, and death would not be believed for an indefinite time; but this I do aver, that, as a result of teaching Christian Science, ethics and temperance have received an impulse, health has been restored, and longevity increased. If such are the present fruits, what will the harvest be, when this Science is more generally understood?" (Page 348.)

Apropos this last quotation, it is to be noted that the membership in the Christian Science Church is restricted to persons who do not smoke or imbibe in alcoholic beverages. Tea and coffee are permissible, but relatively frowned upon.

The second question: How many Christian Scientists are there? This question cannot be answered by anyone outside the "Mother Church," for in the manual of the Church, written by Mrs. Eddy, Article VII, Section 28 states: "Numbering the People. Christian Scientists shall not report for publication the number of members of the Mother Church, nor that of the branch churches. According to the Scripture they shall turn away from personality and numbering the people." It is known, however, that in Seattle, Washington, there were as of January 1, 1956, 16 Christian Science churches in the city, with a combined seating total of 7,500 persons. This would give a figure of approximately 1% of the population in this area. However, while some churches hold two services a day, we cannot assume that each church is filled to capacity, nor that each one who attends is a member, for there are many people who attend the services who are so-called "students of Christian Science" but who are not eligible to membership in the Church. If also we assume that of the 7,500 available seats approximately one-half are occupied by members of the same family (i.e., husband and wife, etc.), then perhaps another 7,500 persons might be included as being under age or members of the family who practice Christian Science but are non-attendants. It might be more nearly correct to assume that there are perhaps 15,000 Christian Scientists (including both members and serious students) in this area, and if so, then they make up 2% of the population in Seattle, and with an annual death total of approximately 8,500 per year, then the Christian Scientists would be "entitled" to 170 deaths per year from all causes and at all ages. Actually, the number of cases reported number considerably less than half that number, more in keeping with a membership equal to the seating capacity of the Churches.

This brings us to the third question: How and at what ages do Christian Scientists die? As subsidiary questions we might also inquire, "How do the Christian Scientist death rates compare with the population-at-large rates?" and, what is more important to the medically minded individual and health officer, "How many of these deaths are preventable?"

The method of procedure in this study has been to take every known Christian Scientist death reported to the office of the King County Coroner for the past 21 years. It is admitted that there may be a few cases in which, at the last moment, a person has been taken under care by a medical practitioner, and when death ensued the medical attendant signed the death certificate without reporting to the coroner or signifying on the certificate that the individual was a Christian Scientist. In a sense these individuals are not "True" Christian Scientists, although it is permissible for a member of the Church to seek surgical and orthopedic care.

It is also admitted that there are a few cases in this series in which the deceased has been previously treated by surgeons, and then as a last hope they have turned to Christian Science. It is felt that both types of cases are relatively few and will pretty well cancel each other, without altering the overall figures.

It was felt that in this type of presentation a series of graphic charts would be more readily handled than a series of figure-studded pages.

In Chart 1 we have tabulated the total reported Christian Scientist deaths per year against the total population of the

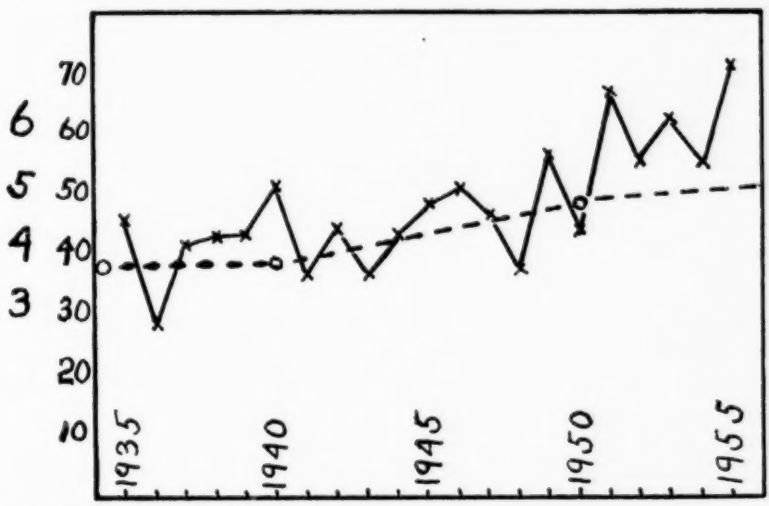

Chart 1. The population of the Seattle, Washington, area in hundreds of thousands, as compared with the number of Christian Scientist deaths reported per year from 1935 through 1955.

Seattle area. It will be seen that the population increase and the Christian Scientist deaths pretty well follow one another, with no significant deviation, and as far as can be determined this parallels the increase in membership in the Church.

Chart 2 shows the average monthy number of deaths among the Christian Scientists, and this shows no remarkable deviation from the overall local average, and no marked seasonal variation.

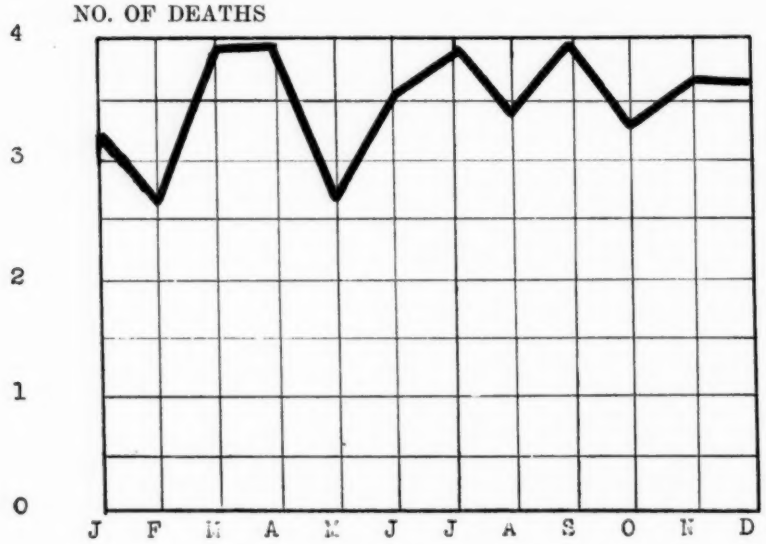

Chart 2. A 15-year average of Christian Scientist deaths per month (1935–1950).

While the picture varies somewhat from year to year, in general the membership in the Church is predominantly female (about two to one), and as shown in Chart 3 the number of deaths per year varies somewhat but in general follows the 2:1 ratio. Also in Chart 3 is shown the total percentage number of Christian Science deaths reported as compared to the total number of coroner's cases, and this may indicate a considerable increase in the membership in the Church, or it may be interpreted as indicating that the existing membership is now reaching an age when more are dying.

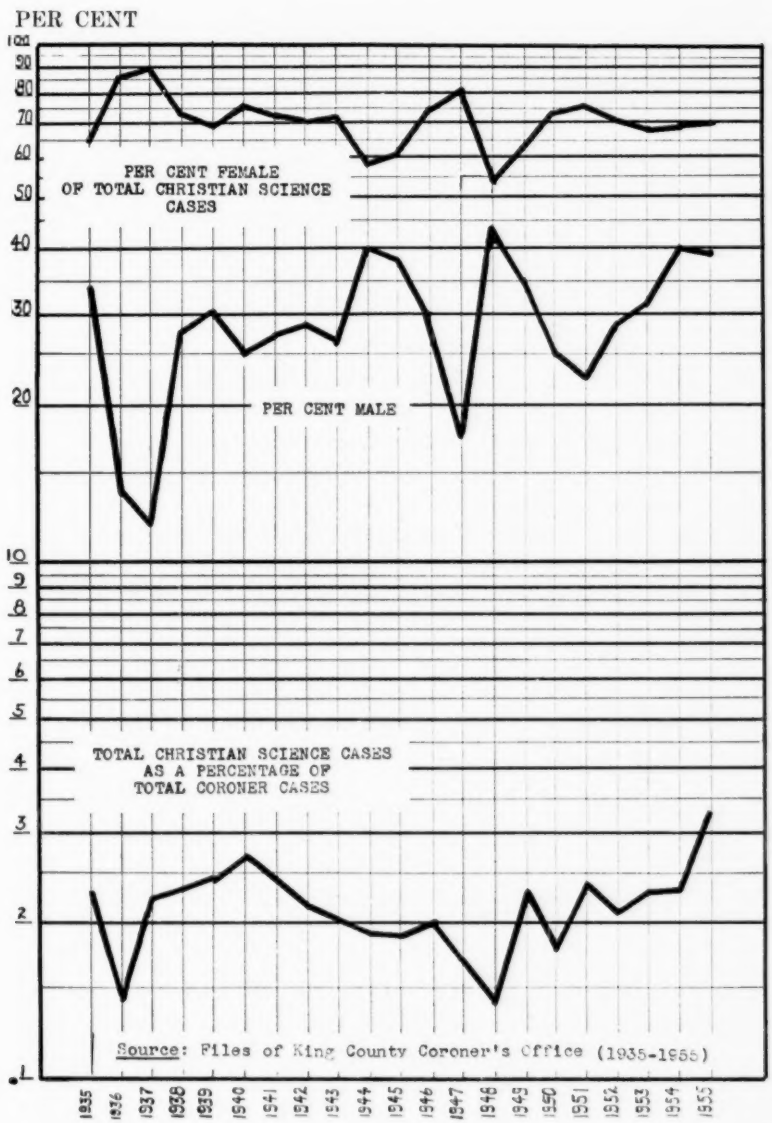
PER CENT
PER CENT FEMALE OF TOTAL CHRISTIAN SCIENCE CASES
PER CENT MALE
TOTAL CHRISTIAN SCIENCE CASES AS A PERCENTAGE OF TOTAL CORONER CASES
Source: Files of King County Coroner's Office (1935-1955)

Chart 3. Showing the percentage distribution (1) of Christian Scientist deaths by sex, and (2) the total Christian Scientist deaths as a percentage of the total cases handled by the coroner's office (1935–1955).

In Chart 4 we have shown graphically the average age at death of the Christian Scientists as reported to the office of the King County Coroner. This does show a slight but very definite trend consistent with that of the population in the state of Washington, and in the United States, namely, that the average age at death has increased from approximately 62 years in 1935 to 70 years in 1955, and also that the average age at death for males is about 3 years less than for women. This latter tends to bear out the statement of Schmid et al. (1) that "The weaker sex will still live about four or five years longer than her married male contemporary. It is interesting to note that at each age level the number of years remaining for the married male is very nearly the same as the remaining years for a married female who is five years older. It might be argued from these statistical relationships that in order to avoid widowhood, a woman should marry a man about five year younger than she is."

The general opinion is that women not only live longer than men, but that married women live longer than single women, and that married men live nearly twice as long as single males

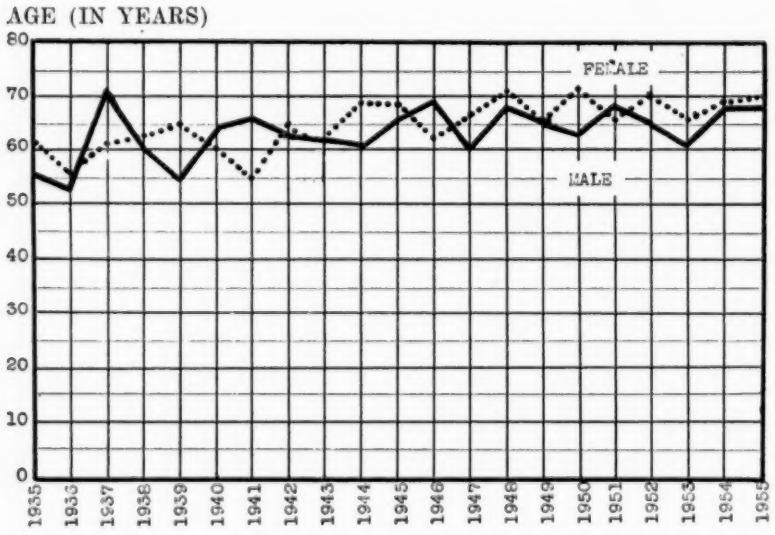

Chart 4. Average age at death, by sex, of Christian Scientists in King County (1935–1955).

(Schmid, ibid.). In Charts 5A and B we have shown the marital status of the Christian Scientists, with the yearly average age at death. This does show that there is quite a definite longevity among widows, but that over the period 1935 to 1955

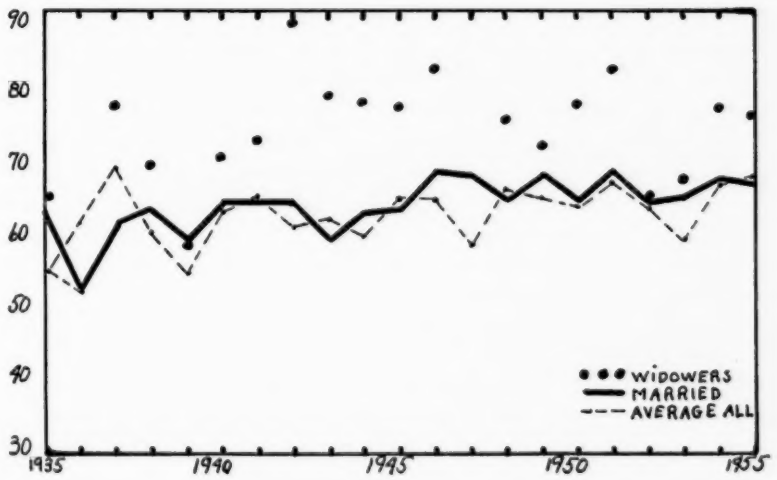

Chart 5-A—Age at Death and Marital Status—Male Christian Scientists.

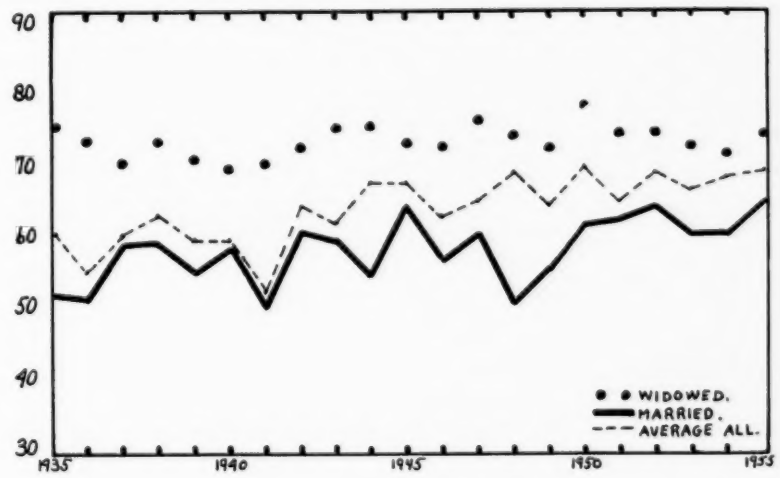

Chart 5-B—Age at Death and Marital Status—Female Christian Scientists.

there is no appreciable increase in that longevity, with the average age in 1935 being 76.1 years, and in 1955 it is down to 75.4 years. On the other hand, the average age at death of the married women has increased from 52.3 years in 1935 to 65.6 years in 1955. The married woman is still considerably behind the widow in longevity.

The single females are very few in proportion to the total, and the averages are probably not too true a picture, but they show an apparent increased longevity of nearly 14 years, from a low of 45 years in 1935 to 79 years in 1955.

The total number of divorced individuals of either sex is so small in this group, that while they are included, the apparent increase in longevity from 55 years to 62 years should be taken "cum grano salis."

Regarding males, the same general statistics are true, i.e., the widower has increased his longevity from 67 years to 77.8 years in the period under consideration. The married male has increased his life span by four years, from an average of 64 years to 68 years. Among this group the number of male children under the age of 10 years has completely deranged the averages, so that to look merely at the figures it would seem impossible to reach manhood if single!

Finally we reach the crux of the study: of what do Christian Scientists die? In Chart 6 we find the commoner causes of death among Christian Scientists by percentage, as compared to the average "run of the mill" coroner's cases, and as compared to the statistics of the United States for 1953.(2)

It is unfortunate that the national statistics do not break down cardiac deaths into the ever increasing category of coronary occlusion vs. other types of heart disease, for in our experience that mode of dying has increased many fold within the past twenty years. As shown in the chart, only a total of 7.5% of Christian Scientists died of coronary attacks, as compared with 32% in a sample of 100 consecutive cases reported to the coroner's office. Among other things, this does bring up the question as to the mode of living, for the Scientists definitely do live a more tranquil life than the population at large. The effect of not smoking or drinking I will not attempt to evaluate. We might also consider occupation as a factor. Over a two-year period the majority of the women were housewives, schoolteachers, or employed in secretarial

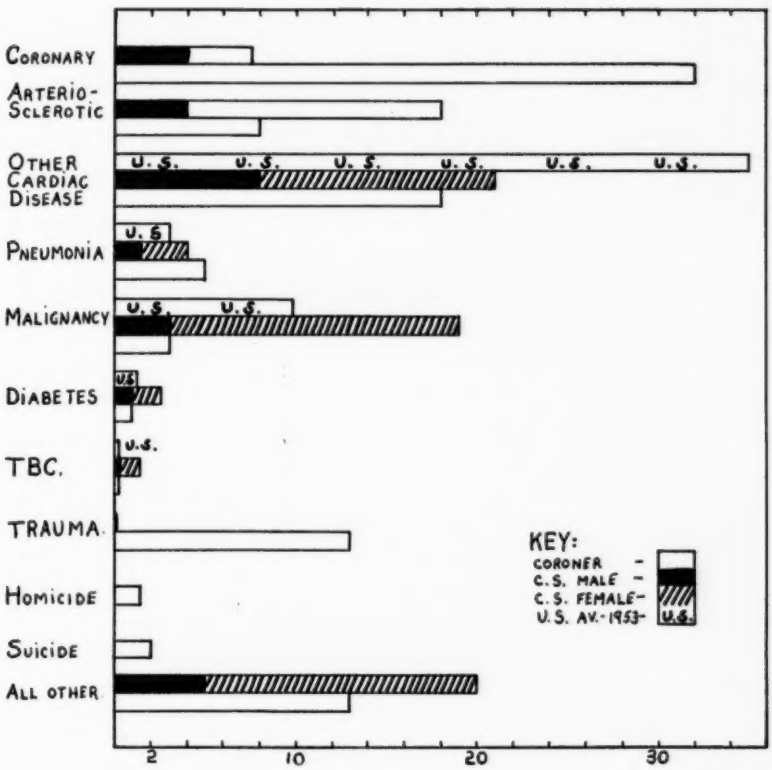

Chart 6. Major causes of death among Christian Scientists as compared to the national average and to the office of the coroner in King County, Wash.

capacity, etc. The men tend very definitely to be of the "white collar" type, with less than 10% being listed as laborers. Race may also be dismissed by stating that in the entire group no non-white persons were found.

With arteriosclerotic heart disease the Christian Science level is far greater than the ordinary levels, but with other types of heart disease (including chronic myocarditis, rheumatic fever, rheumatic heart disease, etc.) the Christian Scientist group is higher than the coroner's group, but very markedly lower than the national average.

Pneumonia is still listed as a potent "killer" in spite of antibiotics. The incidence among the Scientist group is about the same as the coroner's average (which includes many infant deaths under the age of 6 months), and both are somewhat higher than the national average.

Malignancy will be taken up in detail on the next chart, but it does show nearly double the percentage of deaths from neoplasms as does the national average, and quite naturally a far greater percentage than the coroner sees.

Diabetes is generally considered an "amenable" type of illness, but we find that in spite of all the recent medical advances the national death rate from diabetes (and its complications) increased from 19.7 per hundred thousand in 1930 to 25.9 in 1940, and then fell to 14.4 in 1950. Among the Christian Scientists group the deaths from diabetes have been pretty well constant, making up a combined total of only 2.5% of the deaths, about twice the national average.

Tuberculosis deaths in the state of Washington have declined from second place in 1910 with a death rate of 108.4 per hundred thousand population, to 9th place in 1950 with a death rate of 14.8. Among the Scientist group there has been little change over the years under consideration, with the overall total being approximately three times that of the local and national averages, the average age in this group being about 23 years.

Deaths from trauma of various kinds, including automobile accidents, accidental falls, etc., have decreased in Washington state from first place in 1910 with a rate of 116.0 per hundred thousand population, to fourth place in 1950 with an overall rate of 69.6 per hundred thousand. Among the Christian Scientist group we found only three cases in the one thousand deaths. All three of these were females, one was in an automobile collision, was hospitalized and casts applied to her broken limbs, then she went home for "treatment" according to her own beliefs. Another was a cardiac decompensation following an accidental fall with a leg fracture, and the third case was a fat embolism secondary to a fractured leg. These deaths constitute such a small percentage of the total (0.3%) they barely show on the chart.

Deaths from homicide make up an average of 1.5% of our coroner's cases, and suicides, year in and year out, average

2.5%. Among the more than one thousand deaths among the followers of Mrs. Eddy in this group we have not had one single homicide or suicide reported. In my private practice I saw one double homicide, with tetra-ethyl lead administered to a wife and son, followed by Christian Scientist treatments at the request of the father. He was apprehended after the deaths, but was committed to the criminal insane ward of the state hospital.

As regards deaths from malignancy, the Christian Science group averages approximately twice the national average for deaths from neoplastic diseases. A breakdown of these deaths is shown in Chart 7. This shows the total number of deaths from various of the commoner malignancies, and in the case of the diseases peculiar to the female they are "true" figures.

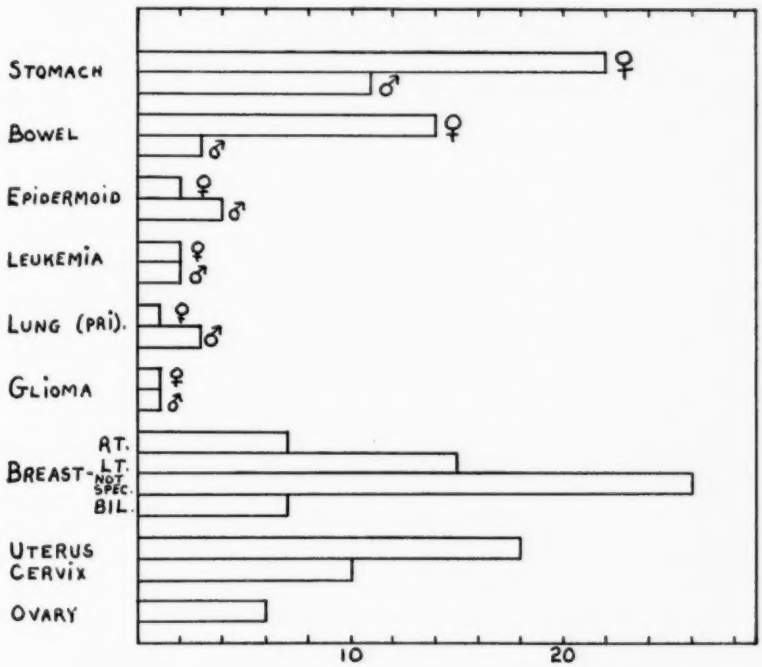

Chart 7. Showing the deaths from various types of malignancy among Christian Scientists, with the actual number of cases of each type, with sex differences.

In deaths common to both sexes it is perhaps necessary to warn the reader that with the female:male ratio 2:1, the male death figures are disproportionate and should be doubled to get a more true picture. It is interesting to note that the deaths from carcinoma of the stomach are more prevalent among the females, and deaths from epidermoid carcinoma, leukemia, glioma and carcinoma of the lung, are about equal in the two sexes. The total of four lung carcinomas in one thousand deaths is far lower than the general average. In hospital practice last year I found 27% of all autopsies were on malignancy cases, and in the first month of this year I found five bronchogenic carcinomas out of a total of 25 hospital autopsies.

Carcinoma of the breast is interesting, for it is the commonest malignancy among females, and perhaps the most amenable to therapy by surgery and/or irradiation. In this study it is twice as common in the left breast as in the right among the cases in which the records indicate the primary source. A large number of cases terminate with ulceration and extensive necrosis of the affected side. The frequent bilateral carcinoma reported here is probably due to direct extension rather than to true bilateral primary neoplasm.

Carcinoma of the uterine fundus, cervix, and of the ovary are quite common, and perhaps here a measure of cure might be expected by medical and surgical treatment.

All of which brings us up to the last part of the third question: "How many of these deaths are preventable?" This is a very argumentative question, and one that can be approached from many angles. I have, rather arbitrarily, selected 43 cases, dying from causes indicated in Chart 8, and with indicated sex and age. All of these cases are less than fifty years of age, and except for one case, no cardiac conditions are included. With a total of 57 carcinomas of the breast, it is not too much to ask that 9 of them survive. With a total of 33 carcinomas of the stomach I have not asked that any survive, but it would seem only reasonable that a cure might be effected in at least one-third, so that 11 would survive. Tuberculosis in this table covers a 21-year period, with some change and improvement in the treatment, but it again seems reasonable that at least four out of the seven in this group should live for a considerably longer time than is shown.

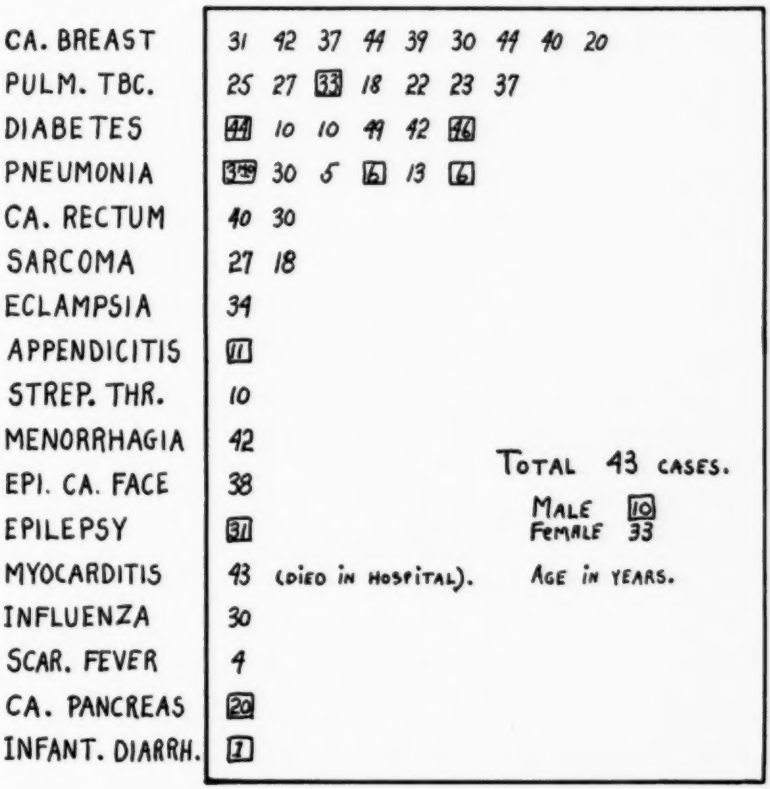

Chart 8. The "preventable" deaths by cause, age and sex for the period 1935–1955.

Diabetes took six lives under the age of 50 years, all of which I believe should have been salvaged.

Pneumonia killed four out of six who were six years of age or less, and this is not out of proportion to the infant deaths we see normally. Perhaps the two older cases might have survived with medical treatment.

The remaining deaths in this list are all self-explanatory with the exception of the "Myocarditis." This individual was a female, age 43 years, whose condition I believe was preventable originally, and then she entered the hospital just a few hours before death, but actually expired without receiving medical attention.

In summation, it is my belief that a minimum of 45 lives could have been saved by medical and surgical care, with a probable additional fifteen out of the 33 women who died of uterine and ovarian carcinoma. This gives a grand total of 60 out of approximately one thousand, or 6%. If this 6% was interest on an investment it would be considered well worth while. With human lives it seems more than well worth while.

When we consider this preventable death total, it appears to me that we might call the attention of the Christian Scientists to their own guide book, "Science and Health," for on page 401 Mrs. Eddy has written: "Until the advancing age admits the efficacy and supremacy of Mind, it is better for Christian Scientists to leave surgery and the adjustment of broken bones and dislocations to the fingers of a surgeon, while the mental healer confines himself chiefly to mental reconstruction and to the prevention of inflammation."

A very highly selected group might be introduced here, namely the deaths of the Christian Science practitioners which were recorded during the period of this survey. They number four men, two of them dying of heart disease at an average age of 69 years, and two of malignancy at an average age of 66 years. The women number 20, with 15 expiring of heart disease at an average age of 71 years, and five of malignancy (including one carcinoma of the lung) at an average age of 65.7 years. There is thus no appreciable difference in longevity between the practitioners and the members of the Church.

Summary

A total of 1,041 Christian Scientist deaths covering the period 1935 through 1955 as reported to the office of the King County (Washington) Coroner are reviewed. Of this total, approximately 70% were female, and the average age at death approximates the Biblical allotment of three score and ten. The widowed female lives a little longer, to an average of 75.4 years, while the married woman lives to only 65.6 years. The increase in longevity shown over 20 years is not greater than the increase in the population at large.

Male Christian Scientists live to an overall average age three years less than the women. Twice as many males die of coronary artery disease as do females, but they are far under

the national average. Arteriosclerotic heart disease takes twice as many females as males, and combined with coronary heart disease the average is nearly double the national average.

In malignancy the Christian Scientists have nearly double the national average and the women are far in advance of the men in all categories except epidermoid carcinoma, leukemia, and carcinoma of the lung. The incidence of carcinoma of the lung is very low, but carcinoma of the breast and genital organs is high.

It is estimated that at least 6% of all Christian Scientist deaths are preventable in the sense that they represent conditions which are amenable to surgery, which treatment is actually approved by the Christian Science Church.

Deaths from trauma, homicide and suicide are practically nil. No homicides or suicides were seen in the entire period.

Conclusions

A survey of Christian Scientist deaths over the period 1935 through 1955 in the Pacific Northwest (King County and Seattle, Washington) reveals that as a whole the women outnumber the men 2:1 in deaths (and probably in church membership); that the average age at death is slightly below the average for the state of Washington for the 1949–51 period; and the women live slightly more than three years longer than the males. Widowed persons live considerably longer than married, and married longer than single. No deaths from homicide or suicide were recorded, and only three deaths occurred as the result of trauma.

Malignancy and heart disease deaths are higher than the national average, and it is estimated that a minimum of 6% of all Christian Science deaths are preventable. It is felt that if the members of the Church of Christ, Scientist, will read and follow the instructions of the Founder regarding matters pertaining to surgery they can reduce the mortality to a considerable extent.

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2. World Almanac, 1955. Published by the New York World Telegram.

Acknowledgments: Grateful acknowledgment is made to Prof. Grant Butterbaugh of the University of Washington for assistance and guidance in the preparation of the charts and graphs. Also to Margaret Peck and Jim Ultican of the King County Coroner's Staff for assistance in compiling the information. Also to the Committee on Publication for the State of Washington of the Church of Christ, Scientist, for the quotations and information relative to the practice of Christian Science.

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Reporting and Classification of Cause of Death in Medicolegal Cases*

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Probably 20–25 percent of the 1½ million deaths registered annually in the United States come within the jurisdiction of the coroner or the medical examiner. Although State vital statistics registration laws differ in detail, virtually all States require the established medicolegal authority to certify the causes of deaths occurring under one of the following conditions:

1. The deceased had not received medical attention;
2. The identity of the deceased or the cause of death is not known;
3. Violence was involved or suspected.

In all States, except one, the enforcement of the vital statistics registration laws is the responsibility of the health department. The health department is also responsible for the issuance of burial permits, maintaining a permanent file of vital records, and for the issuance of certified copies of such records. Since the filing of inaccurate records would serve no useful purpose, it is to the interests of health departments to see to it that the death records are as accurate as possible. With accurate records on all deaths, the health department can discharge fully still another of its basic statutory obligations—to compile, analyze, and publish statistics that present the mortality experience of the general population.

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* Presented before the Section on Forensic Pathology of the American Academy of Forensic Sciences, February 24, 1956, Chicago, Illinois.

Cause-of-death statistics serve a variety of purposes, including medical and pharmaceutical research, accident prevention, crime prevention, sociological and demographic studies, and business and market analysis, to mention a few. Probably their most extensive use is by the health departments which compile them. In the absence of comprehensive information on morbidity, health departments must frequently rely on mortality statistics to measure the extent of health problems, and as guides in planning and evaluating health programs.

Medical and health progress have led to a marked change in the emphasis of public health programs. The chronic diseases, including mental disorders, now comprise a major problem area of public health. With the emphasis on mental health, there is considerable public health interest in the social problems of suicide and homicide. Accidents rank fourth as a cause of death in the total population and the leading cause of death in the age groups between 1 and 34 years. Because of this, public health authorities are now directing more attention to accident prevention. Epidemiological studies are under way, and public health measures are being planned to reduce accidental injuries and fatalities.

The scope and emphasis of public health activities are determined, to a very large extent, by the current relative significance of various causes of illness. The information on death certificates provides much of the needed intelligence.

Accurate information is also needed by agencies other than the health department. The identification and the reporting of specific drugs and poisons involved in a death are a good illustration. It is almost impossible to keep up with all the new drugs and pesticides. In many cases, the toxicity of these products to man is not clear until death occurs and the agent is reported. A single death, if associated with a specific toxic substance, may provide a lead for intensive investigation. Or, if cases of untoward effects of drugs or poisons are reported, mortality statistics may be examined to see the extent, if any, of the lethal effects of the agent in question. The U. S. Food and Drug Administration has major responsibility in protecting the public in the matter of drugs and poisons, and has done much to regulate the packaging and sales of such products. A recent action of the Food and Drug

Administration was to require the labeling of packages of "aspirin" and other salicylates with a warning to keep them out of the reach of children. This action resulted in part from information on death certificates which indicated that fatalities from accidental ingestion of large amounts of "aspirin" by children were not uncommon.

Inherent Difficulties

It is recognized that the very nature of medicolegal cases presents difficulties in making accurate determination of the cause or the circumstances of death. Often the medical history is unknown; informants may have been unobservant, may disagree, or may have reason to conceal or distort the facts. The medical examiner or the coroner must therefore be peculiarly fitted for his task to discharge his responsibility effectively.

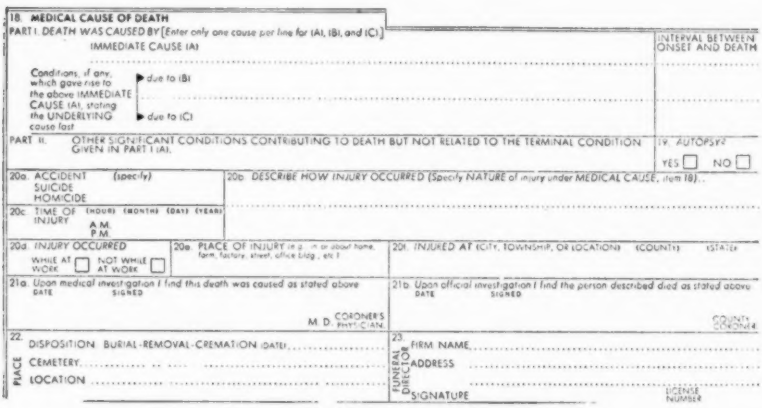
There is need for painstaking investigation, careful sifting and collation of facts in order to reach a just conclusion. Because of the pressure of time, not all cases can receive the attention and consideration which the investigator may feel they deserve. Nevertheless, the medicolegal authority is responsible by law to establish and report the facts about certain deaths.

These facts, as reported on death certificates, are classified by the vital statistics offices. The uncertainties in the minds of the medicolegal authority concerning specific deaths, as reflected in the report of the death, also create problems for the vital statistics personnel who classify causes of death. It is obviously undesirable for the statistician or the statistical clerk to read into the death certificate more meaning than the medical certifier intended to convey.

Design of the Certificate

For this reason, the medical certificate of death (1) was designed in such a manner that the medical attendant would, by completing the certificate properly, determine the single cause to which the death would be attributed. This medical certificate, which has been prescribed for international use, provides (see figure) for the statement in part I—the disease or condition directly leading to death, together with such antecedent disease conditions as may exist, so that the underlying

cause of death is clearly indicated. In part II, other significant conditions contributing to the death but not directly related to the immediate cause of death are to be reported. In the United States, the certificate calls for additional information relating to the time, place, and manner of injury from accident, suicide, or homicide. The facts concerning the external causes of deaths provide valuable information which is not otherwise regularly available.


18. MEDICAL CAUSE OF DEATH
PART I. DEATH WAS CAUSED BY (Enter only one cause per line for (A), (B), and (C).)
IMMEDIATE CAUSE (A)
INTERVAL BETWEEN ONSET AND DEATH
Conditions, if any, which gave rise to the above IMMEDIATE CAUSE (A), stating the UNDERLYING cause last
due to (B)
due to (C)
PART II. OTHER SIGNIFICANT CONDITIONS CONTRIBUTING TO DEATH BUT NOT RELATED TO THE TERMINAL CONDITION GIVEN IN PART I (A).
19. AUTOPSY? YES NO
20a. ACCIDENT SUICIDE HOMICIDE (specify)
20b. DESCRIBE HOW INJURY OCCURRED (Specify NATURE of injury under MEDICAL CAUSE, item 18).
20c. TIME OF INJURY (HOUR) (MONTH) (DAY) (YEAR) A.M. P.M.
20d. INJURY OCCURRED WHILE AT WORK NOT WHILE AT WORK
20e. PLACE OF INJURY (e.g., in or about home, farm, factory, street, office bldg., etc.)
20f. INJURED AT (CITY, TOWNSHIP, OR LOCATION) (COUNTY) (STATE)
21a. Upon medical investigation I find this death was caused as stated above DATE SIGNED M. D. CORONER'S PHYSICIAN
21b. Upon official investigation I find the person described died as stated above DATE SIGNED CORONER
22. DISPOSITION: BURIAL-REMOVAL-CREMATION (DATE)
CEMETERY
LOCATION
PLACE
23. FIRM NAME
ADDRESS
SIGNATURE
FUNERAL DIRECTOR
LICENSE NUMBER

Causes of death are classified according to the International Statistical Classification of Diseases, Injuries, and Causes of Death (2), under prescribed rules of procedure. The classification presently in use is the sixth decennial revision of the International Lists of Causes of Death. The first classification was adopted in 1893. In order to keep abreast of medical and statistical progress, this classification list has been revised about once every 10 years. The present classification was adopted in 1948 and represents a considerable expansion over previous lists.

This great expansion of the classification list has come about primarily because the present list was designed to serve the purposes of morbidity classification as well as its traditional use for the classification of causes of death. Also, provisions were made for a dual classification of accidents, poisonings, and violence—one according to the external causes of injury and the other, the nature of injury. For purposes of mortality statistics, the circumstances or the external causes

of injury have greater significance. This section now provides for greater detail in describing the manner of injury as well as in categorizing for nontransport accidents the place where the accident occurred, e. g., home, farm, industrial place, place for recreation and sports, etc. For motor-vehicle accidents, the types of vehicles involved, as well as the place of accident, and whether the decedent was an occupant of the vehicle or a pedestrian are significant.

To generalize, for accidental deaths, suicides, and homicides, information is needed on the agent involved and manner in which the injury was incurred. This information should be reported in the space on the death certificate provided for the description of how the injury occurred. In some cases, it would be appropriate to also mention the agent in connection with the nature of injury in parts I or II of the medical certificate form. Take, for example, a death from cyanide poisoning. The immediate cause of death would be paralysis of respiratory center and the underlying cause cyanide poisoning. The manner of injury might be described in the item "How did injury occur?" as "inhalation of cyanogas while fumigating hold of a ship."

How the deaths are classified by cause may depend upon the way in which the causes are reported. If the medical certifier should indicate that the death resulted from injury, by reporting the nature of the injury as in part I of the medical certificate, the vital statistics offices will classify the death to the appropriate category of accident, suicide, or homicide on the basis of the information regarding the circumstances of the injury. If the death were determined to be from natural causes, the diseases which led to the death should be reported in part I. In the event that an accidental injury was also involved but regarded as of secondary importance, the fact of the injury should be reported in part II—Other significant conditions contributing to the death. In such cases, the death would be attributed in the vital statistics tabulations to the disease which initiated the sequence of events leading to death. Suicide or homicide would be classified as such regardless of whether the injury was reported in part I or in part II.

Special Classification Problems

There is one problem which gives rise to difficulties in reconciling vital statistics with the statistics of a coroner or medi-

cal examiner's office. It concerns deaths in which the fact of accident, suicide, or homicide is undetermined. Rightly or wrongly, these deaths are classified by the vital statistics offices as accidental deaths. The rationale behind this practice is that suicide or homicide is regarded as a matter of medicolegal determination. Therefore, a death is not classified as a suicide or homicide unless specifically indicated. Perhaps it might be argued that accidents are also a matter of legal determination. However, the judicial seriousness of accidents is probably less than that of suicide or homicide.

Vital statistics offices recognize the legal and administrative importance of these "undetermined" cases. Unfortunately, the cause-of-death classification does not provide categories for such cases, nor does it seem feasible to create new categories. There seems to be little choice but to live with a certain irreconcilable inflation of the accident totals in the vital statistics tabulations, or for the medicolegal authority to indicate in some fashion that the cause was undetermined but it might possibly have been suicide. This would enable vital statistics offices to classify the death to the more likely event.

One other classification procedure might be mentioned here. This is the classification of deaths involving misadventures in therapeutic procedures, including anesthesia and operations. The principal interest of health departments has always been in diseases. Therefore, in a system where only one cause is to be selected for tabulation, the main axis of classification is the disease for which treatment was given. Thus, the vital statistics tabulations emphasize the risk of death from diseases. Misadventures and faulty medical judgment are regarded merely as a part of the risk. Except for abortions and in instances where no other information is reported, therapeutic misadventures are not identified in the statistics. Therefore, while the reporting of medical misadventures is important from a legal standpoint, it does not generally affect the manner in which deaths are classified.

Coroners and medical examiners appear to show some reluctance in certifying "cause undetermined" for deaths from natural causes. In one area, more than 35 percent of deaths reported as coronary diseases were certified by the medical examiner's office. It is our impression that an increasing number of deaths from coronary disease is being reported by

coroners and medical examiners. Some question might be raised concerning the reliability of these post-mortem diagnoses, particularly in the absence of autopsies. Because of the great interest in the diseases of the coronary arteries, this tendency to ascribe sudden deaths to coronary diseases is disturbing. The mortality statistics on diseases of the coronary arteries are very much confused, and much of the confusion is no doubt due to the fashionable use of the term during the past two decades by medicolegal authorities as well as by practicing physicians. Unless there is reasonable evidence for the diagnosis, it would be preferable to report "cause undetermined" or "cause unknown."

Autopsies

The determination of the true cause of death is frequently difficult, even under the best conditions. While the medicolegal authority does not work under conditions that favor precision of diagnosis, the coroner or medical examiner is empowered to order post-mortem examinations. According to data obtained from death certificates filed in 1949, autopsies were reported in 19 percent of the deaths attributed to external causes; in 53 percent of these deaths it was reported that no autopsies were held; and in 28 percent there was no response as to whether or not an autopsy had been performed. In deaths from the so-called natural causes, it was reported that autopsies were performed for 12 percent; no autopsy was made for 62 percent; and no statement about necropsy was made for 26 percent. The actual proportions of autopsies performed are undoubtedly higher than the percentages based on the positive statements concerning autopsies on the death certificate.

Perhaps it is not necessary to hold post-mortem examinations on all deaths involving external causes. Certainly, available facilities and personnel would be an important limitation. By and large, mortality statistics on the accidental causes are probably overstated, and the suicide and homicide totals are possibly too low. Among the accidental causes, there is at least one statistic which is obviously grossly misleading. This pertains to deaths attributed to mechanical suffocation of infants in bed or crib, which is the most commonly reported cause of accidental deaths among infants. In 1954, there were 1,170 such deaths reported in the United States. Studies by

Werne and Garrow (3), Swinscow (4), and others indicate that this problem is greatly overstated by mortality statistics. Careful investigation and examination of infants found dead in a crib or carriage have frequently pointed to fulminating infections and other diseases rather than accidental suffocation as the cause of death. This is a situation where not only are the statistics misleading, but where the parents and the family of the deceased infants experience unnecessary trauma through feelings of guilt for the accident.

Summary

The cooperation of the medical examiner or coroner is most important to the health authority for the following reasons: Many deaths from natural causes coming under the scrutiny of the medical examiner and the coroner involve chronic diseases, a major problem area of public health. The number of deaths certified by the medicolegal authority is numerically large and represents a relatively high proportion of all deaths. These deaths generally present difficulties in ascertaining the cause of death. A large segment of deaths coming to the attention of medicolegal investigators is preventable, and may influence the direction of health programs. The vital statistics offices are in a position to call to the attention of the medicolegal authority the registered deaths that require certification by the medical examiner or coroner. In turn, the medical examiner or coroner can be most helpful to the vital statistics offices by supplying complete medicolegal information as promptly as possible.

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Forensic Pathology Slide Seminar*

Conducted by Arnold F. Strauss, M.D., Norfolk, Virginia

Case 12. Diagnosis: Medionecrosis of Aorta

History: A 56-year-old male of mixed Indian and Caucasian blood was struck by a car sustaining a fracture dislocation of the Atlas on the axis. Six days later while a nurse was washing his face, he turned his head to one side, gave several deep gasping respirations, became cyanotic and clammy, and expired in 2 to 4 minutes.

Case referred to Medical Examiner because of death following injury.

Discussion: The microscopic examination of the aorta reveals a slight intimal hyperplasia with little lipid. The adventitia contains a few perivascular lymphocytes and histiocytes. The media presents changes of a marked mucoid or rather myxomatous change (3). (Figure 1.) Less conspicuous though more important are necroses of the muscle cells with stretching of the elastic fibers. In other areas the elastic fibers appear to be broken or to be lacking. (Figure 2.)

In 1928 Gsell described medionecrosis as due to degeneration of smooth muscle fibers. The next year Erdheim emphasized the mucoid change and cyst formation. They, however, are common in aortas of old people and are possibly an expression of wear and tear and mechanical stress similar to ganglia of the wrist. In 1931 Cellina reported destruction of elastic fibers as the cause of rupture and dissection.

When I examined the slides with medionecrosis, I had the impression that either Gsell or Cellina might be correct in their interpretation and often both seemed to be right. Two years ago, when Gore (1, 3) published his investigation of the large material of the AFIP, I felt greatly relieved of my

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Fig. 1—Mucoid and cystic changes in media of aorta.

Fig. 2—Necrosis of muscle fibers in center of field. Elastic fibers are stretched.

uncertainty when I read that in the age group below 40 elastic changes predominate, in the older group muscle fiber necrosis, and in the intermediate age both are most commonly found. The younger elastic group, beginning at the age of 12 days, often shows longitudinal tears. This is not uncommonly associated with other vascular dysplasias, such as coarctation of the aorta, patent ductus, bicuspid valves, or congenital cerebral aneurysm. Gore believes that inferior elastic tissue may lead to easy vulnerability of the aorta to metabolites, and nutritional interference.

The older, muscular group, extending to the age of 100 years, shows less tendency to vascular anomalies. The tears are generally transverse. Hypertension is common.

Vascularization of the media, possibly an important factor in dissecting aneurysm, occurs in either type. It is from these vessels that the dissecting hemorrhage develops, which is a far more common complication of medionecrosis than the spontaneous tear without bleeding into the wall. In the dissecting type the hemorrhage starts within the wall rather than from blood pushing through the tear, for occasionally there is no tear at all. Most ruptures are just above the aortic valves. With increasing distance from the heart they become rarer. The size and even the number of tears in an individual case, in my experience, decreases with increasing gentleness of the prosector. An aortic wall with medionecrosis can often be torn as easily as paper.

Forensically this case is of interest. Death occurred suddenly 6 days after a car accident leading to fracture of the Atlas. What is the relation between injury and medionecrosis? Since we are dealing with a severely diseased aorta one should not assign more importance to the injury than it deserves. The rupture may be interpreted as due to trauma, while in reality it was incidental or may even have led to the accident. This case was signed out by Dr. Mann (5) as natural death: rupture of the aorta due to medionecrosis. Otherwise, a manslaughter charge would have arisen. There is reasonable doubt that the accident caused the death. No compensation or double indemnity was involved. It is important that the forensic pathologist foresee the consequences of his actions.

In a compensation proceeding I would have taken the stand that there is a possible connection between injury and death. The etiology of spontaneous rupture is unknown. An injury may easily lead to a rupture of an aorta with pre-existing medionecrosis (7). A precedent exists. The Supreme Court of Idaho in Larson v. Blackwell Lumber Co. (8) decided that sudden strain or injury during employment which either causes or aggravates a dissecting aneurysm constitutes death from accidental injury and is compensable.

In case double indemnity had been involved I would have stated that a connection is probable if a study of the tear itself would have shown any sign of cellular reaction, or had I found in the literature convincing cases of medionecrosis with delayed aortic rupture after injury (4, 7). In case of death within two days of the injury, or in the presence of a dissecting aneurysm, I would consider the connection as probable without hesitation. I may have been influenced by the circumstances. A young widow with four little children would make me think twice before saying possible, but not probable. I realize that I am not absolutely scientific and objective.

Practically, we should strive to settle cases rather than to let them go to court. I have made a rule to tell both sides how I will testify and to recommend settling the case out of court on that basis. It has generally worked. At present, the position of the medical expert in court appears to me undesirable. He is supposed to be objective, and at the same time do everything possible for the side that hires him. This difficulty, of course, does not apply to cases under the jurisdiction of the Medical Examiner since he is testifying as a state officer. I would prefer experts called by the court and paid by the losing side or the state, though each side should have the right to bring also its own expert witness. Another alternative would be to have courts consisting of a jurist, the medical expert and a layman before whom both sides, with or without experts, could present their case.

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Case 13. Diagnosis: Lung, Bone Marrow Embolism

History: A 46-year-old white male slipped on the ice while getting out of his automobile on January 4, 1953, sustaining a transverse fracture of the shaft of the right femur. On the morning of January 6, 1953 he suddenly developed convulsions, circulatory collapse, and died within a few minutes.

A death following an injury made this a Medical Examiner's case.

Discussion: The lung presents a slight lymphocytic infiltration in the walls of the bronchi. They often contain a neutrophilic exudate which may extend into the alveolar ducts and some of the alveolar spaces, which occasionally contain a few macrophages. There are areas of atelectasis. Now and then a fibrinous thrombus or a megakaryocyte is seen in capillaries. Old fibrosis of alveolar walls exists. Numerous capillaries are distended and empty. In larger vessels there are sometimes oval or round empty spaces outlined by the surrounding erythrocytes. Some swollen endothelial cells have granular cytoplasm, and in one of the arterioles they also contain brown pigment. Most interesting is the observation of pieces of bone marrow with blood-forming elements and fat cells, which fill a number of the larger vessels. (Figure 1.) Sometimes they are covered with a fresh fibrin deposit. We are dealing with fat and bone marrow embolism.

Although first described independently by Maximow and by Lubarsch in 1898, only 11 cases had been reported until 1951 when Rappaport, Raum and Horrell (1) analyzed 27 additional cases from the AFIP and the V. A. Hospital in Washington, D. C. Bone marrow embolism is observed after fractures and also after convulsions caused by eclampsia, tetanus,

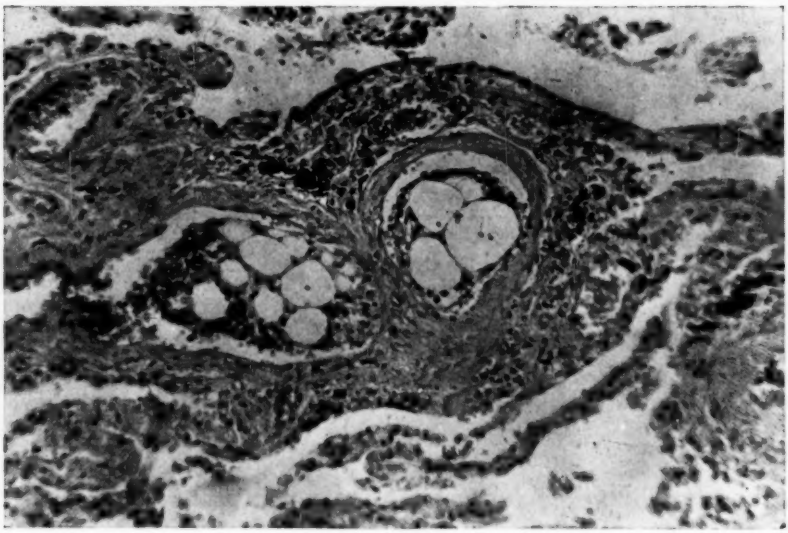

Fig. 1—Two fragments of bone marrow with hemopoietic tissue and fat cells in pulmonary artery.

therapeutic and electric shock, and in one case after topical cocaine and pantocaine application. Rappaport and his associates believe that most likely in all these cases of convulsions fractures had occurred and that there is no doubt about an undiscovered fracture if bony spicules are present in the marrow fragments.

Fat embolism, in contradistinction, occurs without fracture as in blast injuries, pressure asphyxia, burns, CCl_4 poisoning, sickle cell crisis and therapeutic oil injections. No direct relation exists between the severity of fat and bone marrow embolism. With numerous fragments of medullary tissue in the lung fat droplets may be minimal or absent.

The incidence of marrow embolism in cases of multiple fractures is 6%, and in Warren's 100 cases of fat embolism 3% (2). The time interval between injury or convulsion and death tends to be short, often less than ten minutes. Fat embolism, as a rule, occurs rarely until several hours have elapsed. Then, there is possibly emulsification and the amount of fat is large enough to produce injury (3).

Bone marrow emboli extend up to almost .5 mm. in size and are generally too large to cross the pulmonary barrier. The majority lodges in vessels 3.0 cm. from the pleura.

From a medico-legal standpoint there can be no doubt about the relation between injury and death in this case. It is important to keep the possibility of fat and bone marrow embolism in mind in all cases of sudden death after trauma or of unobserved sudden death. There may be no sign of fracture detectable at cursory examination. Virchow was legislator and statesman, and he had a law on legal autopsies enacted in which an examination for fat embolism belonged to the routine procedures. For this purpose a scarcely pinhead-sized piece of lung tissue can be excised during autopsy. Blood is washed off in water. The tissue is teased with needles and examined fresh without pressure on the cover glass. Fat emboli are easily seen as little sausage-like droplets within the capillaries, proving their intravascular location by Y-shape at the point of capillary branching.

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Case 14. Diagnosis: Anthrasilicosis with Superimposed Bronchopneumonia

History: A 59-year-old retired coal miner was visiting at the home of his father when he complained of feeling ill. He became dyspneic and cyanotic, and expired in a few minutes.

Case referred to Medical Examiner because of unexplained rapidly fatal illness.

Discussion: Examination of microscopic sections of the lung reveals three changes: A bronchial pneumonia with sanguino-purulent exudate, linear streaks of anthracosis and fibrosis with marked proliferation of coal dust laden macrophages along the vessels and accompanying lymphatics, and

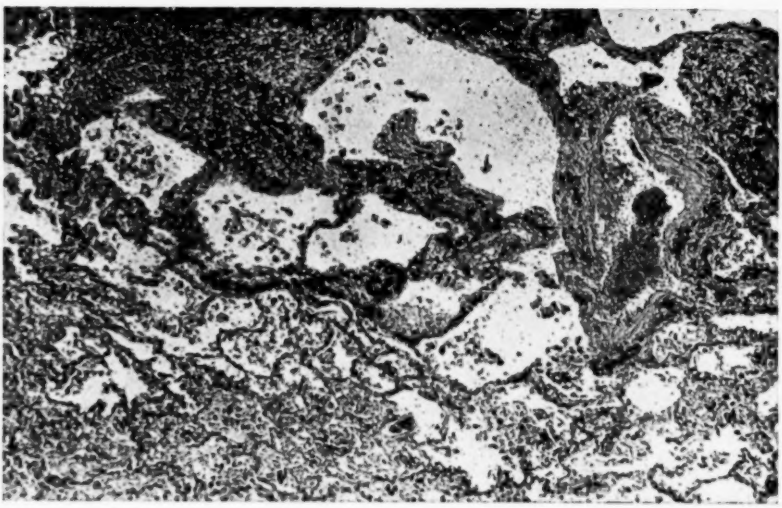

Fig. 1—Linear anthrasilicosis in upper half. Bronchial pneumonia at left lower side.

lastly, nodular lesions. (Figure 1.) A large node, about 3 mm. in diameter, is apparently a conglomeration of a number of smaller nodules consisting of concentric lamellae of hyaline bands with little pigment, surrounded by an irregular, cellular area with much coal dust. (Figure 2.) This zone contains a small, concentric nodule of hyaline bands and occasionally indistinct nodules of epitheloid macrophages. Disregarding the pneumonia there is remarkably little change in the adjacent lung tissue about the node. In other sections we demonstrated smaller nodules of pigmented macrophages and fibroblasts, often with neutrophilic infiltration, even though the surroundings has not a remarkable amount of pneumonia. Now and then, there is a nodule, like a miniature ball of twine. In polarized light tiny crystals throughout the nodular lesions are observed.

There can be no doubt that we are dealing with an anthrasilicosis and a superimposed bronchopneumonia which in the diseased lung led to rapid death. Pneumonia is possibly not more common in silicotic lungs than in others. There is no special disposition as for tuberculosis. But, the occasional rapidly fatal course is characteristic (7), and the finding of

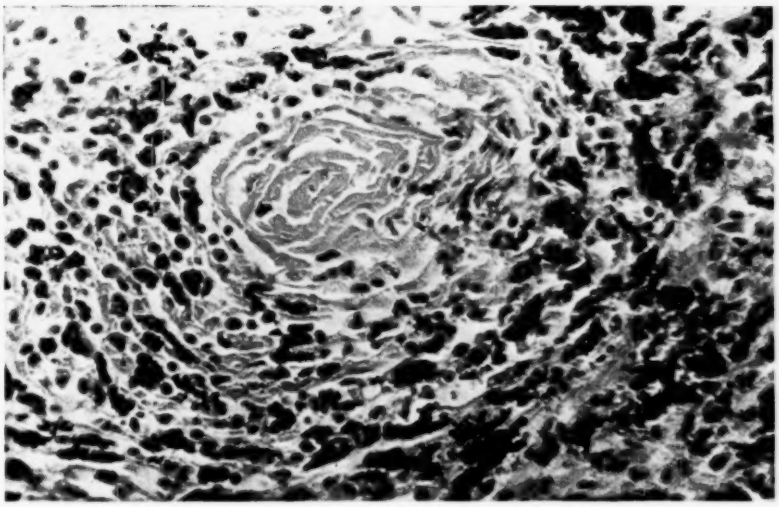

Fig. 2—Lamellated anthrasilicotic nodule.

numerous neutrophils in smaller anthrasilicotic nodules, even though the surrounding alveoli are little afflicted, bears this out morphologically.

Silica is one of the most remarkable substances. This simple compound, SiO_2, as Gardner has shown, can produce all the tissue reactions of the complex, living tubercle bacillus (3). The pathogenesis of the silicotic lesion is well understood (2, 3, 7). Silica particles which have reached the alveoli are phagocytized. The dust-laden mononuclears migrate to the lymphoid aggregations and lymph nodes. Alkaline body fluid produces minimal amounts of silica hydroxide, a strong cytoplasmatic poison. Proliferation begins when the focal concentration of the irritant becomes sufficiently strong. High concentration may lead to necrosis. The lymphatics become blocked by a chronic obstructive inflammation. Then macrophages accumulate along their tracts. Increasing fibrosis leads to further blockage. By now we are dealing with the linear type of mild or early silicosis. Nodules form where drainage fails. Fibers mature to the typical, concentrically woven bands of highly eosinophilic hyalin, a characteristic of silicated collagen. The linear lesion becomes beaded. The stage is reached where the disease is considered to be com-

pensable when seen on X-ray, and at autopsy when visible and palpable. Finally, the blockage is complete. Silica cannot be removed from the alveoli and nodules form throughout the parenchyma proper. Not rarely, wide areas of fibrosis develop caused by unresolved pneumonia and silica (7).

Admixture of other dust modify the morphology and ameliorate the disease. Coal dust (2) suppresses the formation of nodules to a certain extent. They are not so sharply defined and not so uniform in size. The hyalin will be less acidophilic. The central zone of hyalinization may be completely lacking. Non-nodular fibrosis becomes more prominent.

Several factors determine the danger of silica: First and foremost, the particle size which determines rate and severity of tissue response. Particles of 10 to 12 micra provoke a foreign body reaction that progresses very little. If 1 to 3 micra in size, the progressive tissue changes of severe chronic silicosis will result. Smaller particles of 1 micron or less lead to an acute form with death in 2 to 3 years (6). Finer colloidal silica injected intravenously will cause almost instant death of animals (3). Next to particle size the amount of dust, its percentage of free silica, the duration and constancy of exposure, and possibly individual susceptibility are determining factors (6).

Complications of silicosis are emphysema, occasionally with right-sided heart failure. The diminished resistance in nonspecific pneumonia and the tendency to nonresolution has been mentioned. Above all, there is the increased susceptibility to tuberculosis.

Silicotuberculosis has two forms (2, 8): A primary tuberculosis in a silicotic lung will spread rapidly, often in "perinodular" form showing zones of tuberculosis surrounding the silicotic lesions, or as caseous pneumonia with rapid cavitation. A re-infection type, on the other hand, will generally take a very chronic course with a tendency to contiguous rather than bronchiogenic spread. Fibrosis may proceed to such an extent that the tuberculosis becomes unrecognizable. Fibrotic silicosis should be considered as silicotuberculosis until proven otherwise by negative culture and guinea pig. This form is little contagious even though cavities occur. The latter are not multilocular and not trabeculated, and have, histologically, not the trizonal arrangement of pure tubercu-

losis. Upon the fibro-anthracotic wall there is only a thin layer of necrotic tissue. Anemic cavitation of nontuberculous silicosis even lacks the latter. The wall ends as if broken off without any reaction whatsoever. Silicotic nodules in pure form are, as a rule, easily distinguishable from hyalinized tubercles (3). Tubercle bacilli grow, silica cannot. There is no change in the lung tissue in the neighborhood of the silicotic lesion.

The forensic pathologist who guards public and industrial health should be familiar with pneumoconioses. He will be aware of them in industrial areas. Otherwise, he can easily miss them, though they may be the compensable cause of death of a laborer who has moved from one town to another.

Carbon is inert, but recently graphite (5) has been accused of causing nodular fibrotic and caseous granulomas with numerous giant cells containing large asteroid bodies (40 mu). Graphite crystals are seen in alveolar spaces. The oily metallic sheen in areas of extensive fibrosis will grossly point to graphite lesions.

Asbestosis (4, 6) is due to fibrous hydrated magnesium silicate. It generally occurs in processing and use, rather than in mining of the material and is due to the mechanical effect of the asbestos fibers. They are too large to be cleared from the terminal bronchioles and alveolar ducts, and cause fibrosis. They are easily recognizable as fungus like, segmented threads with bulbous ends, yellow to orange brown from absorption of iron-protein.

Bauxite (4) fumes from manufacture of abrasives cause central pulmonary fibrosis with severe peripheral emphysema, commonly leading to spontaneous pneumothorax, even as a cause of death.

Cadmium fumes (4) will cause necrotizing bronchitis similar to phosgen, and in less acute cases, edema with marked swelling of the cells of the alveolar lining which form solid sheets extending to the bronchioli.

Beryllium (1), used in the manufacture of fluorescent lamps, causes acute and chronic lesions. The former resemble the effect of cadmium, primary atypical pneumonia, and Q-fever pneumonia and the mononuclear fibrinous pneumonia caused by the Friedlander bacillus. The chronic form is histologically characteristic. It is a nodular inflammation

vaguely similar to sarcoid, but with central granular necrosis and indistinct epitheloid cells. The granuloma throughout may have some lymphocytic infiltration. Giant cells commonly contain conchoidal siderotic inclusions and rarely a few asteroid bodies. Presence of fluorescent beryllium granules and a specific stain can establish an absolute diagnosis. Cases of people not working with the manufacturing of beryllium have been reported (1).

The constant introduction of new substances in an ever-expanding industry should be kept in mind in the study of lungs with unknown lesions. Chemical examination and morphologic methods must support each other.

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Case 15. Diagnosis: Rhabdomyosarcoma

History: A 69-year-old white housewife bruised her arm while doing housework. About three months later she noticed a lump in the region of the bruise and consulted her physician who removed a tumor from the brachio-radialis muscle. One year later she noticed a peculiar swelling of the entire forearm which her physician thought to be due to hemorrhage or inflammation. Under local therapy the swelling subsided in two weeks leaving a 3.0 cm. "knot" at the previous operative site in the muscle. A second operation revealed a tumor mass localized in the brachio-radialis muscle, but with no true capsule. A supracondylar amputation was performed. She refused further medical treatment and while visiting relatives in the State of Virginia died about six months later.

Because of the unattended death the case was referred to the Medical Examiner.

Discussion: At the boundary of cross-striated muscle there is a tumor which is composed of plump and elongated spindle-shaped cells and bizarre giant cells. Some areas are fibrous. The smaller cells are sometimes band-like and their nuclei may take a tandem position. Other cells have the shape of a racquet. (Figure 1.) There are large, more monotonous areas where the cells are plump, somewhat resembling squamous epithelium and forming a mosaic-like pattern. The fast-growing cells about vessels are often round, small and primitive. The cytoplasm is generally more or less eosinophilic, occasionally markedly so. It may also be granular. The elongated cells show longitudinal striation, and though never distinct, a vague pattern of cross-striation can sometimes be recognized. The giant cells are extremely bizarre. (Figure 3.) They have large, multiple nuclei and either finely granular or opaque, or dark eosinophilic cytoplasm. Hyaline globules are not uncommon. Neither are vacuoles which tend to be peripheral and lead to the picture of a spider cell. (Figure 2.) A peculiar feature of some of these giant cells is their close connection to vessels. They often seem to form the end of capil-

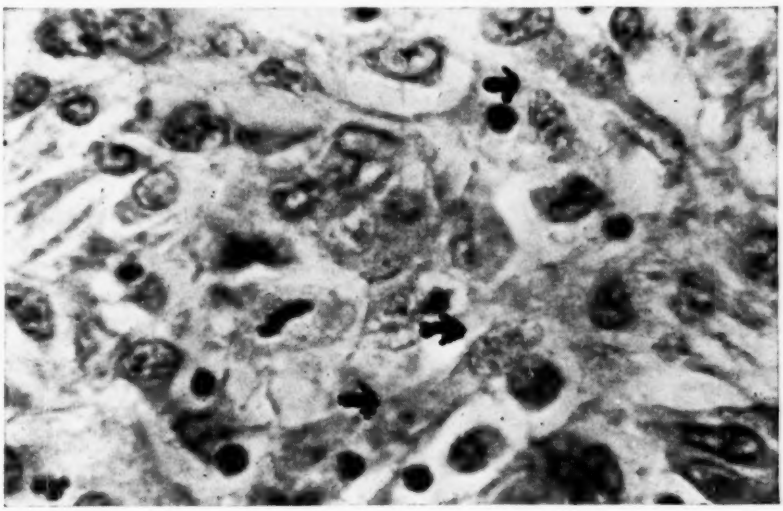

Fig. 1—Characteristic cells of rhabdomyosarcoma: Racket cell (upper pointer), tandem cell (lower pointers).

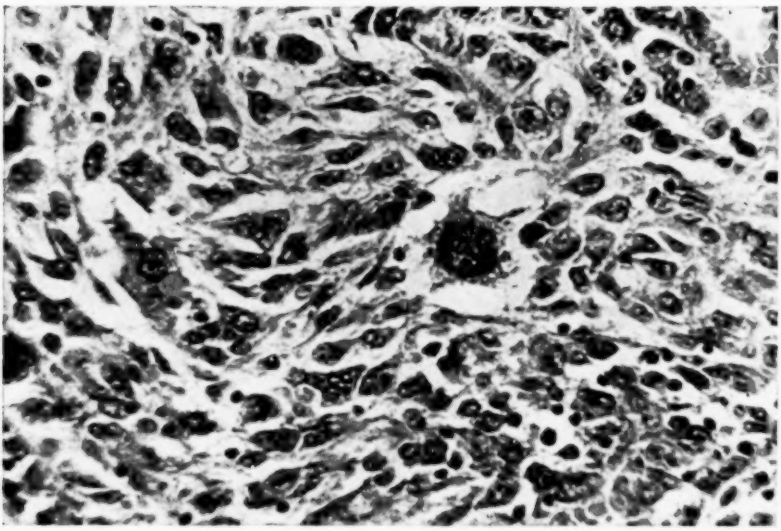

Fig. 2—Spider cell at right center.

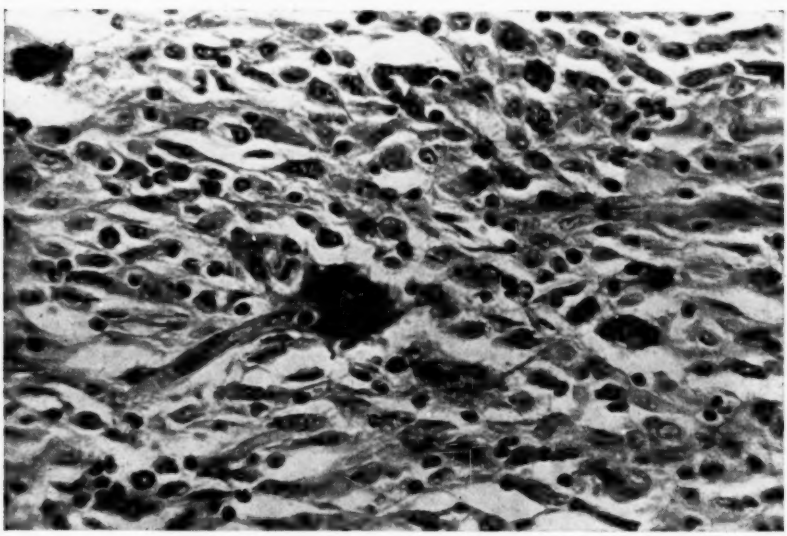

Fig. 3—Tumor giant cell developed at end of capillary at the left side of the giant cell. These giant cells are more characteristic for liposarcoma. Vascular and fat tissue are related embryologically.

laries like a puffed capillary sprout similar to the giant cells one sees in an epulis.

Bizarre giant cells rule out fibrosarcoma. They are seen in tumors deriving from bone, fat and muscle. The most bizarre ones with pyknotic nuclei one sees in liposarcoma. Our tumor shows the spider cells, the racquet and strap cells, the nuclei in tandem position and at least a vague pattern of cross-striation all which characterize a rhabdomyosarcoma. The admixture of other mesenchymal components cannot be denied definitely. The relation to vessels of some of the giant cells, their bizarre clumped nuclei and the finding of fat in some of their vacuoles may be due to a liposarcomatous component in this tumor.

The patient gives the history of bruising her arm 3 months prior to the time when she noticed a lump in the region of the bruise, a not uncommon story in many compensation cases. Moritz in his book, "The Pathology of Trauma" (4), begins the chapter on trauma and tumor: "The cancerigenic potentialities of mechanical trauma would probably have long since ceased to stimulate any significant amount of scientific interest were it not for the fact that so many claims for compensation are filed each year in which it is alleged that tumor has been caused by mechanical injury." This case brings the forensic problem of single trauma and tumor into focus. Though in our case there arose no claim for compensation, such claims are frequent. There is possibly no field in forensic medicine where the scientific and the practical approach are less related than in tumor and single trauma.

Experimentally malignant tumors have never been produced by a single injury. But, we must not forget that the methods used in production of experimental cancer are only in exceptional cases explanatory for human cancer. The well-attested trauma of operations is not known to have ever been followed by malignancy (3).

The contrast between incidence of trauma and alleged traumatic cancers is too great. Statistics have shown that the occurrence of cancer in a large number of accident cases is the same as in the general population. World War I did not produce any increase of cancer. In 3,710,371 gunshot wounds treated in the German Army, 5.3 cases of malignancy were observed per one million cases. This is statistically an insig-

nificant number, especially if one keeps in mind how many wounds of previous wars were subject to chronic irritation by infection.

Still the coincidence of trauma and tumor remains impressive whenever it occurs. Coincidence has a powerful influence on our minds. It stimulates the search for casual relationship resulting either in new insights or superstition and myth. Are we entitled to say there is no possibility whatsoever that single trauma can cause cancer? As long as we do not understand the causes of malignancy fully I believe we cannot. Single trauma may elicit cancer in prepared soil, similar to the Deelman effect (8). We have no proof that cancer can be caused by single trauma, but we cannot prove either that trauma can never cause cancer.

If we examine the attitude of the medical profession toward the problem we find in publications a definite trend away from causative relationship. This is exemplified by reading three publications from men of the same hospital group: Memorial Hospital in New York. Coley (1) in 1898 points to the relationship. Ewing (2) in 1935 does not believe in it, but does not definitely deny it. Stewart (6) in 1947 states, "Attempts to rely on single trauma to explain cancer depend on the exercise of a primitive form of reasoning. They present a carry over from the prepathological days." The average physician when testifying in court still often has not passed the Coley stage. He is impressed by coincidence. Often his natural instinct to help is stronger than objectivity.

What is the attitude of the courts? There is likewise a trend away from recognition of traumatic cancer, as compensation commissioners become more and more acquainted with medical problems. But the basic attitude of the courts is well expressed in a decision of the Supreme Court of Virginia, my home state, from which I quote almost verbatim. It deals with a case of sarcoma of the rib after a fall with incapacitation from the time of injury to death 15 months later. In Winchester Milling Corporation v. Sencindiver the decision reads:

"Medical opinions are frankly and at best but theories. The courts must take a common sense practical view. Boiled down to its last analysis the medical theory is that there is a relationship between the receipt of injury and origin of sarcoma.

With this in mind the court finds that a perfectly healthy man suffers an injury and from that time on is incapacitated; he grows worse and worse and sarcoma develops at the site of the injury from which he dies. The lay mind, under such circumstances, can reach no other conclusion than that reached by the industrial commission, namely that the sarcoma was either caused by the injury or aggravated by it. Courts will continue to decide this way with a full sense of justification and without apology until the cause of cancer is definitely and scientifically established."

Ewing (2) worked out certain rules for certifying a malignancy as traumatogenic. They have the wisdom of insight and common sense. If we follow them the epidemic of traumatic cancer will be stopped without undue hardship.

The criteria are as follows:

(1) Authenticity and adequacy has to be established. This is a most difficult task when there is no scar, if one thinks of the motives involved, the unreliability of witnesses and, lo and behold, of clinical histories.

(2) Previous integrity of the area involved has to be established. In many cases this is impossible. But this postulate has led to routine X-rays of all fractures by most orthopedists. Many a pre-existing lesion is now discovered.

(3) The tumor site should be at the exact location of the injury. Scars or adequate medical records can establish this fact.

(4) The time limits should be reasonable. A growth which is found at the time of injury or a short period thereafter cannot be caused by it. A fast-growing malignancy should be discovered earlier than a slow one. Bridging symptoms in tumors are often worthless. They may only point to a pre-traumatic lesion.

(5) Positive diagnosis of the presence and nature of tumor is a self-evident requirement.

Another problem is the question of aggravation (2) of a pre-existing tumor by trauma. Sudden appearance of metastases is sometimes accused of being due to trauma, but is a common occurrence, too often observed without trauma. Biopsies do not lead to distant spread. There is more evidence that pressure may disseminate a tumor. As long as we palpate tumors gently, we should not rule out pressure as a pos-

sible factor of spread. Laceration of a growth leading to hemorrhage or infection may hasten death and likewise the rupture of a cyst with a malignant lining. A glioma may bleed from a minor head injury.

It cannot be definitely ruled out that metastases may tend to localize in a traumatized area. It is unlikely, but is mentioned by Ewing (2). Among his cases is one where the site of repeated injections became that of the only subcutaneous metastasis.

There is no doubt that chronic irritation may lead to malignancy. Carcinomas are common in sites of old inflammation and in scars, especially after burns. Sarcoma is rare (3). But it is also a rarer tumor than carcinoma. I should like to mention a liposarcoma which I observed in a 45-year-old white male which arose under a burn scar of 35 years duration.

My feeling is that cancer caused by a single injury without irritating sequelae may be almost as rare as the mutation of blood groups.

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Some Legal, Economic and Social Aspects of Homicide in an Urban Area*

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This homicide study is a modest beginning of an exhaustive survey of criminal justice in the Greater Cleveland area identified as Cuyahoga County. Within the community are 57 suburbs clustered around the core city of Cleveland—a population of approximately 1,400,000 persons living within 436 square miles. The period surveyed extends from January 1, 1947 to December 31, 1953. These seven years are strategic, for the 1950 census statistics represent the precise middle of the period. Since any homicide study is a study of people, census facts are one source of information. Fortunately, in Greater Cleveland, an active, progressive Welfare Federation is also a reservoir of community facts and figures. A recent publication of this agency entitled "Measuring Leisure Time Needs" proved invaluable for this homicide survey. As a means of analyzing social conditions within various neighborhoods, the Welfare Federation study of Cuyahoga County divided the county into 42 social planning areas. The traditional census tracts represent primarily a division on territorial size and population; these social planning areas were

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The complete homicide study will be published as a volume of the Law-Medicine Series of Western Reserve University and the Cuyahoga County Coroner's Office, Cleveland, Ohio.

carved out on the county map with an eye toward economic, social, ethnic and cultural facts which unified the individual areas into more or less cohesive neighborhoods. Cleveland's Annual Real Property Inventory also provided facts.

With this background material available, the records of the Coroner, Prosecutors, and Police Departments were exhaustively studied for the 1947–1953 period.

These gross facts were unveiled. Six hundred sixty-two homicides were committed. For 655 of them the scene of the homicide was ascertained. Sixty-two per cent of the deaths occurred in an area equal to six-tenths of one per cent of the land area of the county where eight per cent of the county's population resided. This area of heavy homicide lay within the eastern side of the city of Cleveland. It represented only three of the forty-two social planning areas of the county: Central, Central-East, and Central-West. Homicides did occur in 35 of the county's 42 areas but in only 10 areas were there 10 or more homicides for the period studied.

An intelligent analysis now demanded not only a study of homicide for the whole county but also a concentrated attention on these three areas with a large number of homicides.

The first interesting fact is the high correlation of the residence of the assailant, residence of the victim, and scene of the homicide. In the three areas with the greatest number of homicides, all three of these factors could be pinpointed within the same area. Not so for the other 39 social planning areas.

Next a formula was evolved to produce the homicide rate for each of the county's 42 areas. This formula indicated the number of assailants who lived in the individual area per 10,000 population, excluding persons younger than 18 and over 60 to produce a more accurate statistical figure. The homicide rate of the top ten areas indicated even more the startling concentration of homicides within the three areas already identified.

The percentage of non-white population, overwhelmingly Negro, within the fourteen areas with the highest rate of homicide reveals at first glance the highest concentration of non-white in the three areas with the highest homicide rate.

HOMICIDE RATE OF THE SOCIAL PLANNING AREAS
Arranged by QUINTILES (Approximate)

AREA		HOMICIDE RATE
FIRST QUINTILE—	Central-West	72.2
	Central	62.1
	Central-East	24.1
	Kinsman	18.1
	Goodrich	11.9
	Downtown	9.6
	North Broadway	7.6
	Hough	7.3
SECOND QUINTILE—	Glenville	6.3
	Mount Pleasant	6.2
	University	5.8
	Norwood	4.6
	Clark-Fulton	4.6
	West Side	4.2
	Corlett	3.9
	Near West Side	3.6
	Euclid	2.4
	North Collinwood	2.4
THIRD QUINTILE—	Lee-Miles	1.9
	Tremont	1.7
	Chagrin Valley	1.6
	South Brooklyn	1.6
	Jefferson	1.6
	Parma-South	1.5
	Woodland Hills	1.1
	Puritas-Bellaire	1.0
FOURTH QUINTILE—	Fairview-Olmsted	0.8
	South Broadway	0.8
	West Shore	0.7
	Cleveland-University Heights	0.7
	Denison	0.7
	South Euclid-Lyndhurst	0.5
	Shaker-Beachwood	0.5
	South Collinwood	0.5
	East Cleveland	0.4
FIFTH QUINTILE—	Southwest County	0.0
	Lakewood	0.0
	Garfield	0.0
	Cuyahoga Valley	0.0
	Bedford-Maple Heights	0.0
	Riverside	0.0
	Edgewater	0.0

PERCENTAGE OF POPULATION WHICH IS NON-WHITE IN FOURTEEN SOCIAL PLANNING AREAS

AREA	PER CENT OF POPULATION NON-WHITE
West Side	0.1
Clark-Fulton	0.1
Norwood	4.2
University	10.4
Mount Pleasant	22.2
Glenville	25.1
Hough	4.9
North Broadway	1.1
Downtown	8.0
Goodrich	3.1
Kinsman	52.0
Central-East	81.7
Central	95.3
Central-West	77.2

But more interesting is the homicide rate in Central-East which is only one-third of the rate in Central-West. The non-white population in these two areas is approximately the same.

Next a study of certain economic and social facts reveals these correlations with the homicide rate:

1. As the median family income of the area increases the homicide rate decreases. Central-West, the highest homicide rate area, has the lowest median family income, $2051.50. Central has $2369.50, and Central-East, $2703.

2. As the median schooling (by grade completed) increases the homicide rate decreases. This is particularly noticed in Central-East where the median schooling exceeds the average median of the City of Cleveland, despite the high percentage of non-whites.

3. As the density of persons per net acre within the area increases the homicide rate also increases. The same correlation can be found in the overcrowded housing factor, although the difference between Central-East and its two associated areas is not so great as one would expect from the wide difference of homicide rates.

4. The age of dwellings apparently has little significance in influencing homicide. Many areas of the county have older

dwellings than Central-West, including Central-East, which has only one-third the homicide rate.

5. Substandard housing, however, is significant. As it increases, so does the homicide rate.

6. When the number of owner-occupied dwellings increases, the homicide rate decreases, especially in the top three homicide areas.

7. In general, areas with a high degree of public and private assistance programs also reflect higher homicide rates. Aid for the aged recipients, public assistance cases, number of children accepted for service indicate this; however, the correlation is not as good as other factors such as income, education, substandard housing.

8. The facts on illegitimate birth rate, juvenile delinquency, neglect and dependency complaints also reveal good correlation in the highest homicide rate areas, but outside this extreme the correlation becomes less clear.

9. Tuberculosis and infant mortality are reflected much like the preceding two categories: good correlation in the highest areas with less correlation as the homicide rate declines.

The study "Measuring Leisure Time Needs" produced a series of indices of area characteristics and social needs. Each index was composed of a number of factors. In computing a given index an effort was made to weigh the characteristics which went to make it up in such a manner as to produce the most reliable index possible. There follows a list of the indices and the component factors which comprise them.

After the indices were computed for all 41 social planning areas (the Downtown area was excluded as atypical) the areas were then ranked according to the magnitude of each index. By utilizing these indices of social problems and the area characteristics determined by the homicide study, a comparison with the homicide rates for each individual area is possible. The 41 social planning areas (excluding the atypical Downtown) are divided into five groups and ranked from one to five—the first group containing the areas with the highest homicide rate and down to the fifth group of areas where the rate is the lowest. The same quintile arrangement is made for the social problems indicated by the "Measuring Leisure Time" study and area characteristics determined by this homicide study. Using the homicide rate quintiles as the basis, the quintile ranks of each area's social problems and area characteristics are easily compared.

INDEX	COMPONENT FACTORS
1. Socio-Economic Status—	Median family income, median school grade completed, and rate (per cent) of managerial and professional workers to total employed persons.
2. Undesirable Neighborhood Conditions—	Converted and miscellaneous dwelling units, flats over stores, age of dwellings, and substandard housing. ("Substandard housing" consists of dwelling units which are dilapidated or which lack private bath.)
3. Financial Dependency—	Aid for the Aged and public relief.
4. Space—	Population density and overcrowded housing.
5. Crowded Housing Conditions—	Overcrowded housing and the number of married couples without their own households.
6. Stability of Population—	Population movement within the county (1949–1950), population movement into the county (1949–1950), percentage of owner-occupied dwelling units, percentage of converted and miscellaneous dwelling units.
7. Social Maladjustment—	Juvenile delinquency, child neglect and dependency, private agency child-placing, and illegitimate birth rate.
8. Family and Individual Adjustment Problems—	Family agency cases, private youth agency cases.
9. Ill Health—	New tuberculosis cases, and infant mortality.

COMPARISON OF SOCIAL PROBLEMS AND AREA CHARACTERISTICS WITH HOMICIDE RATE RANKS BY QUINTILES OF THE SOCIAL PLANNING AREAS

Social Planning Areas	QUINTILE RANKS		
	Homicide Rate	Social Problems	Area Characteristics
Central-West	1	1	1
Central	1	1	1
Central-East	1	1	1
Kinsman	1	1	1
Goodrich	1	1	2
Downtown *	–	–	–
North Broadway	1	2	2
Hough	1	1	1
Glenville	2	2	2
Mount Pleasant	2	2	3
University	2	2	1
Norwood	2	2	2
Clark-Fulton	2	3	2
West Side	2	3	3
Corlett	2	3	3
Near West Side	2	1	1
Euclid	2	4	5
North Collinwood	2	4	3
Lee-Miles	3	2	4
Tremont	3	1	1
Chagrin Valley	3	5	5
South Brooklyn	3	4	4
Jefferson	3	5	4
Parma-South	3	3	5
Woodland Hills	3	3	3
Puritas-Bellaire	3	3	2
Fairview-Olmsted	4	5	5
South Broadway	4	2	2
West Shore	4	5	5
Cleveland-University Heights	4	5	5
Denison	4	3	2
South Euclid-Lyndhurst	4	5	5
Shaker-Beachwood	4	5	5
South Collinwood	4	3	3
East Cleveland	4	4	3
Southwest County	5	4	3
Lakewood	5	5	3
Garfield	5	4	4
Cuyahoga Valley	5	3	4
Bedford-Maple Heights	5	2	4
Riverside	5	4	4
Edgewater	5	4	2

More dramatically, if all 41 areas of the county (excluding the atypical Downtown) are ranked from 1 to 41, with the

highest number representing the lowest status, then divided into quintiles with the average taken for each quintile, the following table emerges:

AVERAGE RANK BY HOMICIDE QUINTILES	
HOMICIDE QUINTILE	AVERAGE RANK IN SOCIO-ECONOMIC STATUS (highest rank is lowest status)
1 (highest rate)	36.85
2	24.50
3	19.12
4	13.00
5 (lowest rate)	12.57

If the thirteen areas with the highest homicide rate are compared with their rank in the socio-economic status, conclusive proof emerges to support the generalization that the lower the socio-economic status of an area the higher the homicide.

RANKING OF 13 AREAS AS TO SOCIO-ECONOMIC STATUS		
AREA	Homicide Rate Rank	Rank (out of 41)
West Side	29	25
Clark-Fulton	30	31
Norwood	31	33
University	32	9
Mount Pleasant	33	29
Glenville	34	24
Hough	35	27
North Broadway	36	37
Goodrich	37	38
Kinsman	38	40
Central-East	39	36
Central	40	41
Central-West	41	39

Closer study of the three areas with the greatest number of homicides where the bulk of the Negro population lives reveals that *the percentage of Negroes in an area is, in itself, not an index of the homicide rate.* Economically and socially the Negro residents of Central-East are consistently in a better position by all of the measuring indices described in this study. These residents produce only one-third the homicide rate of their neighboring areas—Central and Central-West. This fact not only explains the sharp difference in homicide rates but also strengthens the generalization that homicide is a social phenomenon related to other social phenomena.

Attention is now turned to certain legal aspects unveiled by the 662 homicides studied. In 454 of these cases felonious homicide charges (first and second degree murder and first degree manslaughter) were preferred. Justifiable homicides were ruled in 157 cases (35 by police officers), while 51 cases could not be classified for various reasons, including 23 unsolved cases. Homicides averaged 95 a year, with a low of 84 in 1950 and a high of 106 in 1952. The month of March appeared the lowest, with 5.3 per cent; August with 11.2 per cent was highest. Yet, if one breaks down the seven-year totals to study the annual monthly homicides, year-to-year fluctuations for any given month are too great to indicate any significant trend. Over one-fourth, or 27 per cent, of all homicides occurred on Saturday, with Sunday and Friday following in order. Weekends thus provided 62.3 per cent of all slayings, while the hours between 6 p.m. and 3 a.m. represented the time when 62.5 per cent of the homicides occurred.

A table containing the disposition of all cases of felonious homicide reveals several interesting facts: the low number of convictions as charged by the indictments; the slight difference in the number of convictions found by court and jury; only *one* accused found not guilty by reason of insanity; the large number of cases "no-billed" by the grand jury, where an indictment was refused when a slaying had occurred.

Of the persons charged with felonious homicide 76.4 per cent were Negroes, and the remainder white. Negro defendants were 68.1 per cent in first degree murder, 81.4 per cent in second degree murder, 77.3 per cent in first degree manslaughter.

DISPOSITION OF FELONIOUS HOMICIDES
1947–1953

PART I

I.	Number convicted as charged by indictment		99
	a. Pleaded guilty	24	
	b. Found guilty	75	
	1. By court	29	
	2. By jury	44	
	3. Unknown	2	
II.	Number convicted of lesser offenses		171
	a. Pleaded guilty	87	
	b. Found guilty	84	
	1. By court	28	
	2. By jury	56	
III.	Not guilty		106
	1. By court	43	
	2. By jury	63	
IV.	Not guilty by reason of insanity		1
V.	Insane at time of trial		16
VI.	Nolle prosequis		1
VII.	"No Bill" by grand jury		41
VIII.	Discharged upon preliminary examination		15
	TOTAL		450

PART II

I.	Abated by death of accused before trial		2
II.	Accused not apprehended		5
	a. Whereabouts unknown	4	
	b. Accused in jail in another state	1	
III.	Trial of case pending		2
IV.	Disposition of case unknown		3
	GRAND TOTAL		462

Of all Negroes accused of murder first degree, 35.9 per cent were convicted; 31.2 per cent were convicted of murder second degree; 18.8 per cent of manslaughter first degree; and 14.1 per cent were found not guilty. Similarly, white defendants were convicted of murder first in 35.7 per cent of the cases; murder second in 35.7; manslaughter first in 21.4 per cent; and found not guilty in only 7.1 per cent. This remarkable

coincidence of the disposition of cases against Negroes and whites is indicative of equal justice being applied. In cases where probation is available, 15% of the white persons convicted were given a suspended sentence as compared to 17.9% of the Negroes.

Only 9.3 per cent of the Negroes charged with felonious homicides were accused of killing white persons; 5.5 per cent of the whites were accused of killing Negroes.

The total of 462 persons accused of homicide represented only 64 women, or 13.8 per cent. Fifty-two were accused of slaying males and twelve females.

The ages of the assailants were determined in most cases. Nearly 21 per cent were in the 26-30 year age group; 19 per cent from 31-35 years; 11 per cent from 21-25; and 10 per cent in each of the 36-40 and 41-45 age groups.

The types of conflicts culminating in felonious homicides in Greater Cleveland can be divided into three categories: quarrels of a mostly petty nature, marital discords in which one spouse kills the other, love or sex disputes in which the deceased is slain by one other than his spouse or "common law" mate. These categories coincide with the homicide survey of Houston, Texas, reported previously by Professor Henry A. Bullock (1).

The weapons used to slay victims in felonious homicides are divided into several categories: 55.2 per cent firearms (pistols and revolvers 46.9%, shotguns 6.9%, rifles 1.4%); 26.7 per cent cutting or piercing instruments (21.2% knives, 3.4% specific "stabbing" weapon unknown, 2.1% razors, scissors, ice picks, nail files, hatchets, meat cleavers); blunt instruments 6.7%; manual assaults 6.1%; strangulation and asphyxiation 3%; other various means 2.2% (drowned in bathtub, thrown out of window, boiling lye thrown, arson, automobile, poison).

A compilation of the weapons used, on the basis of the assailants' race, produced the following table: *

* These percentages are based upon the weapons and methods used by a total of 357 Negro assailants and 116 white assailants. The following method was employed in compiling these totals: The slaying of one victim by 2 white assailants, both assailants having guns and having shot the victim, was counted as 2 deaths by firearms by white assailants. Conversely, where 1 white assailant shot and killed 2 victims simultaneously, one white assailant would be credited with having chosen firearms in one instance. The races of the slayers of 25 victims are not known.

I.	Firearms—	Negroes (201 cases)	56.3%;	Whites (60 cases)	51.3%
II.	Cutting and Piercing Instruments—	Negroes (114 cases)	31.9%;	Whites (15 cases)	12.8%
III.	Strangulation and Asphyxiation—	Negroes (4 cases)	1.1%;	Whites (9 cases)	7.7%
IV.	Assault, Manual—	Negroes (10 cases)	2.8%;	Whites (14 cases)	12.0%
V.	Non-cutting and Non-piercing Instruments—	Negroes (23 cases)	6.4%;	Whites (13 cases)	11.1%
VI.	Drowning—	Negroes (1 case)	0.3%;	Whites (none)	0.0%
VII.	Lye—	Negroes (3 cases)	0.8%;	Whites (none)	0.0%
VIII.	Poison—	Negroes (1 case)	0.3%;	Whites (2 cases)	1.7%
IX.	Arson—	Negroes (none)	0.0%;	Whites (2 cases)	1.7%
X.	Automobile—	Negroes (none)	0.0%;	Whites (1 case)	0.9%
XI.	Thrown out of Window—	Negroes (none)	0.0%;	Whites (1 case)	0.9%
TOTALS—		Negroes (357 cases)	100.0%;	Whites (116 cases)	100.0%

A similar table comparing male and female assailants resulted in this:

Weapons Used—Comparison by Sex *

I.	Firearms—	Males (242 cases)	59.2%	Females (19 cases)	29.2%
II.	Cutting and Piercing Instruments—	Males (96 cases)	23.5%	Females (33 cases)	50.8%
III.	Non-cutting and Non-piercing Instruments—	Males (34 cases)	8.3%	Females (2 cases)	3.1%
IV.	Manual Assault—	Males (23 cases)	5.6%	Females (1 case)	1.5%
V.	Strangulation and Asphyxiation—	Males (9 cases)	2.2%	Females (4 cases)	6.2%
VI.	Poison—	Males (2 cases)	0.5%	Females (1 case)	1.5%
VII.	Lye—	Males (no cases)	0.0%	Females (3 cases)	4.6%
VIII.	Drowning—	Males (no cases)	0.0%	Females (1 case)	1.5%
IX.	Thrown out of Window—	Males (no cases)	0.0%	Females (1 case)	1.5%
X.	Arson—	Males (2 cases)	0.5%	Females (no cases)	0.0%
XI.	Automobiles—	Males (1 case)	0.2%	Females (no cases)	0.0%
TOTALS		Males 409 cases	100.0%	Females 65 cases	100.0%

* The methods of totaling the sex of the assailants is the same as that used in totaling the races of the assailants. See explanation accompanying preceding table. The sex of the slayers of 25 victims is not known.

Alcohol, too, plays a role in felonious homicide. Over one-third the victims (36.6%) by blood tests revealed 0.15% or more alcohol. An additional 12.8% had been drinking but the blood tests indicated these victims were within the "safe" zone and not under the influence of alcohol. Seven per cent of the victims lived too long for an accurate blood test but other evidence (statements of witnesses primarily) indicated the victim had been drinking alcohol. In the alternative, 32.6% of the casualties had negative blood tests and 11.2% lived too long for tests to be made and no other evidence of drinking was revealed.

An analysis of the statistics in justifiable homicides reveals the same general degree of intoxication in the victims; 60.2% had been drinking (40.8% with 0.15% blood alcohol or more, 15.9% in the first or "safe" zone of drinking—less than 0.15% blood alcohol, 3.8% lived too long for a blood test but other evidence revealed drinking).

Two obvious generalizations are drawn from these statistics on firearms and alcohol. The ready use of small, concealable weapons (pistols and knives) indicates that assailants have their weapons available, usually on their person. Alcohol is present in a majority of victims at least. These contributing factors set the stage for the typical petty argument which ignites the situation resulting in death.

Conclusion

This paper presents a small segment of the facts gathered in the homicide study of Greater Cleveland. Enough is displayed, however, to indicate the complexity of the cause of the age-old problem of man slaying man, as well as the widely diversified methods by which the administration of criminal justice disposes of the legal problems created.

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Oliver Schroeder, Jr., Director, the Law-Medicine Center of Western Reserve University and the Cuyahoga County Coroner's Office.

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Application of Blood Grouping to Derivative Citizenship*

Leon N. Sussman, M.D., F.A.C.P., New York

"American citizenship is indeed a prize for those seeking to escape the misery of Communist China."(1)

No one doubts this statement, and ever more desperate become the efforts to establish citizenship by means fair or foul. To extend the benefit of citizenship to those whom it rightfully belongs on the one hand, and to resist the efforts of the many others not legally entitled to these benefits on the other hand, becomes the delicate job of the Immigration and Naturalization Service and the State Department. In most of these instances the problem of derivative citizenship is essentially a question of parentage. The applicant presents his case for entry into the United States, claiming that he is the child of a United States citizen. The government, when rejecting this application, denies this and demands a blood test to establish nonpaternity.

The enormous increase in applications from Chinese for derivative citizenship, amounting to 7000 claims in three years, alerted the services, and blood testing was introduced. The applicant children were tested in Hong Kong and the alleged parents were tested here in the United States. The results indicated that in 40 percent of the cases parentage was excluded! By the use of the three blood group systems accepted in medico-legal proceedings (A-B-O, M-N, and Rh-Hr) it has been shown that only about 50 percent of false claims could be excluded (2). It thus follows that about 80 percent of claims for derivative citizenship were indeed false! *

* Presented at the Annual Meeting of the American Academy of Forensic Sciences, February 23–25, 1956, Chicago, Ill.

* Wiener points out that the 50 percent exclusion rate of false claims only applies for non-*paternity*. If the mother and father are *both* false the per-

Table 1. Chances of Excluding Paternity

A-B-O	20.0%
M-N	18.0%
Rh-Hr	25.0%
Combined	50.8%

The accelerated investigation stimulated by this wholesale fraud resulted in suspicion of the existence of an immense "immigration ring" whose motivation and scope could only be guessed. The pattern of operation was as follows:

> "(1) the alleged father is a citizen by derivation; (2) the father returns to the ancestral village to marry; (3) a child is born within a year; (4) the father returns to the United States after the wife has conceived a second time; (5) other children are conceived, in some cases, upon subsequent visits to China; (6) when the children are in midteens, they apply to come to the United States; (7) usually the lastborn child is not seen by the father until arrival in the United States; (8) each visit to China produces another 'crop' of sons; (9) apparently there is no impotence, because every visit to China results in offspring; (10) the offspring are preponderantly male; (11) the offspring are all born in an unknown rural village, where the homes and villages are described as being alike; (12) there are no doctors, only midwives; (13) all offspring survive and are strong and healthy."

Of equal interest are the findings that in a study of 317 suits for derivative citizenship it was reported that there were 1215 male children as against 167 females, and a similar study in Hong Kong revealed that among family applicants the ratio of reported births was nine male children to one female child. These unusual circumstances aroused more suspicion and investigation finally revealed the operation of the brokerage ring where claims of derivative citizenship were fraudulently created for a fee.

A birth certificate was not available in any of the cases. Family histories—known as Halgoons—were bought and sold

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centage of exclusions obtained is higher than 50 percent, therefore the true figure of total exclusions should probably be 70 percent rather than 80 percent.

by brokers for thousands of dollars. These written family histories were memorized, both by the teen-age male applicant and his alleged father.

There were no old insurance policies in which the applicants were named as beneficiaries. Evidence of remittances being sent to the applicants, when presented, seldom dated back more than two years. At times old letters and photographs were submitted, but the Immigration and Naturalization Service has proof that many of those letters were of recent origin and placed in old envelopes, and that many of the photographs were of infants other than the applicants. At times composite photographs have been presented, some quite crude, others so cleverly prepared as to be most difficult to detect. Rarely was conclusive proof presented to show that a filial relationship had existed over a period of years and was not merely a recent invention. The applicants relied solely on their self-serving statements concerning the alleged relationship.

Before the use of blood tests by the American Consulate and the Immigration and Naturalization Service, the only effective method of demonstrating fraud was the technique of separate interrogation and comparison of testimony. This interrogation was time-consuming and could be successfully circumvented by the fraudulent applicant who was able to memorize a complete family history. Applicants were speedily advised, through well-organized channels, of new subjects about which questions were being asked by Consular and Immigration officers.

In one case a Chinese father and three alleged sons were in complete agreement as to the number of steps in a ladder leading from the ground floor to a loft in their claimed home in China; but disagreed as to the location of an outside toilet. Discrepancies were noted in answers to that particular question in most of the cases examined during a given week. After that, there was a fair degree of agreement on the subject of outside toilets.

Applicants have certain contact points in Hong Kong where persons are paid to assist them in learning the material to which they will later testify under oath. Cases are on record of an applicant memorizing thousands of questions and answers. The applicant is usually supplied with photographs depicting the persons he is to claim as relatives; a map of the

village in which he will claim to have been born and lived; a floor plan of his alleged home in the native village which will show the location of the various rooms, doors, windows, furniture, and where various people had slept in that house; a diagram of the village school, the ancestral hall, or any other building that he might be expected to know about if he were a true member of the family claimed.

It has become the practice for these applicants, immediately after appearance before an American consular officer for interrogation, to send an airmail letter to the alleged father in the United States in which is set forth each question asked and the applicant's answer thereto.

For years immigration inspectors, relying solely upon discrepancies in the lengthy testimony upon which to base a denial of the claim to citizenship, rarely found a subject upon which the applicant and his witnesses had not been coached. For all the services rendered in making it possible for the applicant to enter the United States, the brokers extracted fees that averaged $2000 (3).

The number of blood tests performed on members of this racial group resulted in considerable statistical material of anthropological importance in studies of blood group gene distribution. Previous studies of blood groups in Chinese have been reported by Miller, Rosenfield and Vogel (4) in 1951 on 103 persons, Miller, Tannor and Hsu (5) in 1950 on 190 persons, Simmonds, Grayden and Semple (6) in 1950 on 250 persons, Wiener, Sonn and Yi (7) in 1944 on 138 persons, Levine and Wong (8) in 1943 on 334 persons and Allen and Boyd (9) in 1943 on 101 persons. The present author's series of 706 persons represents the first large group tested with all five available Rh-Hr antisera (**Rh_0, rh′, rh″, hr′, hr″**) as well as with **Kell** and **P** antisera (10). The figures obtained indicate agreement with previous investigators in:

1. The absolute absence of the A_2 agglutinogen.
2. Higher frequency of the B agglutinogen.
3. Higher frequency of M over N.
4. The extreme rarity of the type rh individual.
5. The highest reported frequency of the Rh_1Rh_1 phenotype.

6. The absence of the **Kell** factor.
7. The presence of **P** factor in only 33 percent of individuals tested.

The comparison of the obtained figures with those obtained for Caucasoids and Negroids in New York City by Wiener (11) is shown in Table 2.

Table 2. Frequencies (Percent) of Blood Groups

Blood	*Caucasoids* *	*Negroids* *	*Chinese* †
0	42.2	51.5	40.0
A_1	30.3	20.5	29.3
A_2	8.5	6.5	0
$A_{1,2}$	0.3	2.5	0
B	13.5	15.5	25.5
A_1B	3.9	1.5	5.2
A_2B	1.2	2.0	0
M	29.9	23.0	31.4
N	19.9	25.5	19.1
MN	50.1	51.5	49.5
rh	11.25	7.5	0.25
rh′	1.07	0.5	0
rh″	0.47	0.5	0
Rh_O	3.20	41.5	0
Rh_1rh	36.13	25.5	8.75
Rh_1Rh_1	22.4	3.0	61.5
Rh_2	11.85	14.5	5.0
Rh_1Rh_2	13.5	6.0	24.5
Kell	12.3	2.3	0
P	75	98	34

In tests performed on 34 Chinese families in which the child and alleged mother and father were available seven exclusions of parentage, or approximately 20 percent were obtained. In another series of 71 cases where the tests were limited to only the child and his alleged father, only eight exclusions, or

* Wiener, A. S.: "Heredity of the Rh Blood Types." Am. J. Hum. Genet., Vol. II, #2, June, 1950.

† Present study.

approximately 11 percent were obtained. Table 3 amply demonstrates the greater efficiency of blood grouping tests for paternity exclusion where both alleged parents are available for the test (10).

Table 3

	No. of Cases	No. of Exclusions	Percentage Excluded
Child and alleged father and mother tested	34	7	20
Child and only alleged father tested	71	8	11

Unscientific judicial decisions limiting blood testing to only the alleged father and child and recently to only the child (12) are inherently ridiculous, and indicate total ignorance of this branch of forensic medicine.

The importance of the use of all available blood group systems to obtain maximum exclusion rates is demonstrated by Table 4, which analyzes the blood group systems under which the exclusions were obtained.

Table 4

Total Families tested	Exclusions Obtained Under System			
	A–B–O	M–N	Rh–Hr	Total Excluded
105	4	8	4	15*

Table 5. Illustrative Cases of Parentage Exclusion

	Putative Father	Mother	Child	Exclusion
1.	O M Rh_1Rh_1	A_1 N Rh_1rh	O MN Rh_2Rh_0	rh" factor
2.	A_1 M Rh_1Rh_1		A_1 N Rh_1Rh_1	M-N type
			A_1 M Rh_1Rh_1	
3.	A_1 MN Rh_1Rh_1	A_1B MN Rh_2Rh_0	A_1 N Rh_1Rh_1	
			O N Rh_2Rh_0	A-B-O group
4.	O N Rh_1Rh_1		O M Rh_1rh	M-N types
			O N Rh_1rh	
			O N Rh_1rh	
5.	O N Rh_2rh		O MN Rh_1Rh_1	hr' factor

* One case excluded under both M–N and Rh–Hr.

In this small series, the fact that 25 percent of the exclusion were obtained by using the Rh-Hr system make it important that blood grouping tests should not be considered complete unless the Rh-Hr types are included. Illustrations of cases in which exclusion were obtained are given in Table 5.

Conclusion

The medico-legal application of blood grouping tests has been extended to include another area in which filial relationship is a factor. The use of this scientific and impersonal tool by the State Department and the Immigration and Naturalization Service has aided these agencies in the performance of their assigned duties. The value of blood testing has again proven itself by demonstrating the falsity of paternity claims in approximately 80 percent of the applications made for derivative citizenship, thus exposing a vast brokerage ring, trafficking in human beings.

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The Incidence of Barbiturate Intoxication Observed at the Cuyahoga County Coroner's Office*

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Twenty-four nights of sleep for each person in the United States! This was theoretically possible if all these people took their share of the 1951 production of barbituric acid derivatives as 1½ grain tablets. Figures available for the first four months of 1955 indicate current barbiturate production is probably in the same order of magnitude.

The availability of this huge supply of sedatives implies that many more individuals use them than is generally recognized. Popular magazine articles help propagate this concept (1–3). These articles are based on statistical studies which have reported a relatively high incidence of acute and chronic barbiturate intoxication (4–9). Some obvious facts are not generally recognized or properly evaluated in these studies. A considerable amount of barbiturates is used by veterinarians for therapeutic purposes. Another large quota of the barbiturate production is utilized for anesthetic purposes in both man and his pets. Additional quantities of barbiturates are used in chemical laboratories as chemical reagents. It is thus difficult to determine exactly how much of the total barbiturate production finds its way into human consumption for use as sedatives.

The statistics quoted on fatal barbiturate poisoning are more or less reliable as in the documentation of the reported

* Presented at the Annual Meeting of the American Academy of Forensic Sciences, Feb. 23–25, 1956, Chicago, Illinois.

death. In some cases deaths are alleged to be due to barbiturates merely on the basis of anamnestic reports. Unless there is pathological and chemical evidence to corroborate the diagnosis of death due to barbiturates, it is a tenuous one!

The above discussion is not meant to imply that fatal barbiturate intoxication does not occur, but merely that it may not be as common as we are lead to believe by the existing literature. In Cuyahoga County (Ohio) barbiturates have accounted for more of the deaths due to chemical agents than any other substance except carbon monoxide. In the period 1943–1954, 165 of 961 poisoning fatalities were due to barbiturates. This is an average of 14 deaths a year, or 10/10,000 deaths in the county.

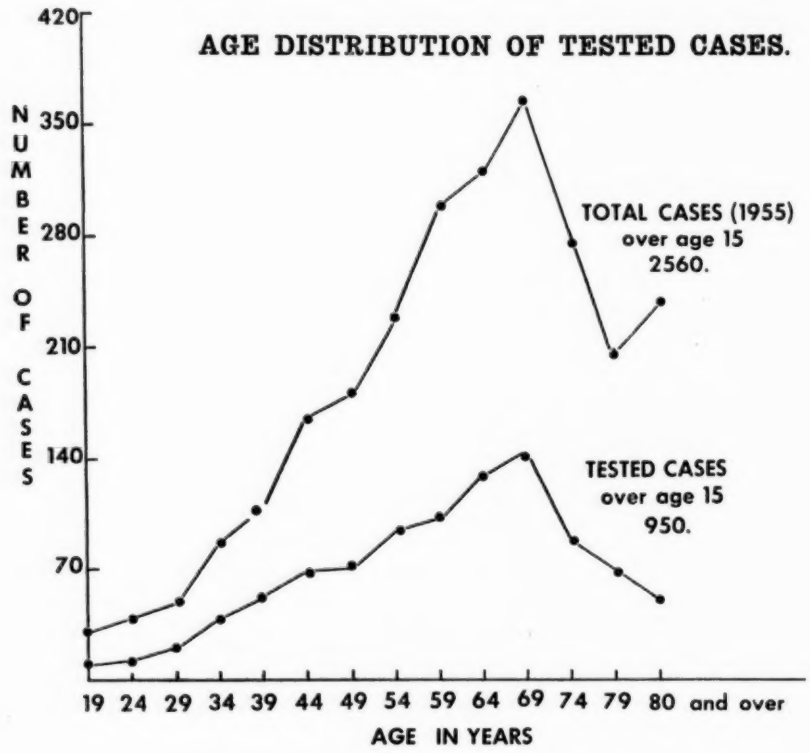

Fig. 1—Age distribution of tested cases. Each point represents all cases in the 5-year age group whose maximum is indicated on the figure.

This investigation was designed to determine the relationship between barbiturate ingestion and the cause, mode and manner of death in cases investigated by the Cuyahoga County Coroner's Office in 1955. Since barbiturates are sedatives, it was thought originally that anyone known to be active prior to their demise probably would not be under the influence of barbiturates. Consequently, the first cases investigated were only those people found dead, whose death was unwitnessed. Some time later a study of the role of barbiturates in violent deaths was added to the project. Finally, the question was raised whether or not the accumulated data presented a true cross section of all Coroner's cases, since a selective choice was made to eliminate many presumed negative cases. Therefore, in one month (November 1955) the majority of Coroner's cases were investigated without any discrimination.

Figure 1 presents the distribution according to age of the cases investigated by the Cuyahoga County Coroner's Office in 1955. The curve of the cases tested for the presence of barbiturates parallels that of all the Coroner's cases. This indicates an adequate distribution of cases with respect to age was included in the study. The only obvious difference in the curves is in the group over 80 years of age. Many of these cases were not tested because they were elderly victims of accidental falls who died at a considerable period of time after the accident, while under medical care and supervision.

Figure 2 presents the distribution of the cases studied as a function of the mode of death. These data are compared with the total cases received by the Office during the year. Approximately ⅓ of all deaths due to natural disease and to violence were studied. The reason for the low ratio between the number of accidental deaths studied and the total cases has already been mentioned previously.

It is evident from Table 1 that approximately ⅓ of all the cases studied were women. This is consistent with the similar ratio of women in all the Coroner's cases. The distribution between white and colored races in tested and total cases is also reasonably similar. On the basis of these facts it is evident that the cases studied in this project were a fair sampling of the Coroner's cases in 1955.

Of the 950 cases studied, 70 or 7.5% had absorbed some barbiturates. One-half of these positive barbiturate cases

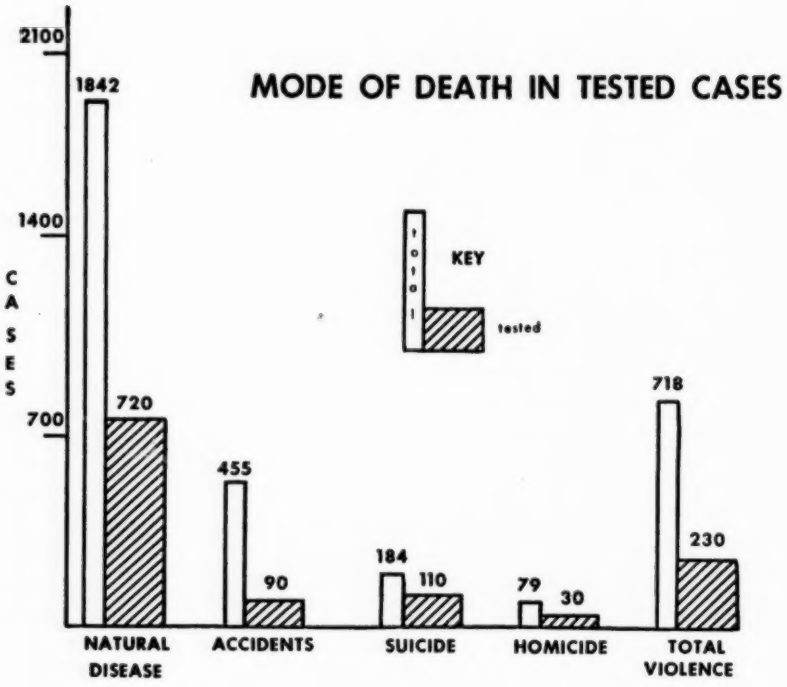

Fig. 2—Mode of death in tested cases. Total refers to the number of Cuyahoga County Coroner's cases in 1955. Tested refers to the total number of cases tested for barbiturates in the entire study.

(35) were found among those individuals who died of natural disease. In each of these cases only therapeutic amounts of the drugs were found in the biological material submitted for analysis. The number of males, 20, was greater than the number of females, 15. The number of white people involved, 29 or 85%, was far greater than the colored.

In the deaths due to violence, women composed ⅓ of all the cases studied. But, of the 35 positive cases found in this group, 60% were women. This is in decided contrast to the positive barbiturate cases in natural deaths where the males outnumbered the females. Nineteen of the positive cases in violent deaths were the result of acute barbiturate intoxication. In the two others, one fall and one drowning, the pres-

TABLE 1

DISTRIBUTION OF CASES TESTED FOR BARBITURATES IN 1955

	MALE		FEMALE		WHITE		COLORED	
	CASES	TESTED	CASES	TESTED	CASES	TESTED	CASES	TESTED
NATURAL DISEASE 1842	1336	485 (20)	506	235 (15)	1479	531 (29)	363	189 (6)
ACCIDENTS 455	302	60 (7)	153	30 (10)	390	67 (16)	65	23 (1)
SUICIDE 184	127	72 (7)	57	38 (10)	167	95 (17)	17	15
HOMICIDE 79	54	16	25	14 (1)	16	7	63	23 (1)
TOTALS 2560	1819	633	741	317	2052	700	508	250

Cases refer to all cases over 15 years of age seen in the Cuyahoga County Coroner's Office in 1955. Tested refers to all cases over 15 years of age that were tested for the presence of barbiturates. The numbers in parentheses indicate the number of cases in which barbiturates were found.

ence of the barbiturates may have been a contributory factor to the death. Again, as in the natural deaths, the number of white people involved was exceedingly higher than in the colored—33 to 2!

Figure 3 summarizes the data on the 70 positive barbiturate cases. Of the 19 acute barbiturate intoxications, 15 were women and 4 were men, 19 were white and none were colored. It seems as if barbiturates are used equally by white men and women, but that the white women are the ones who are

the chief victims of accidental overdosage or suicidal attempt. The low incidence in colored people is probably a function of at least two things. One, their mores are such that they resort to means other than poisoning in their suicidal attempts. Two, their economic status is such that seldom are barbiturates in their homes, and consequently, accidental overdose is a rarity.

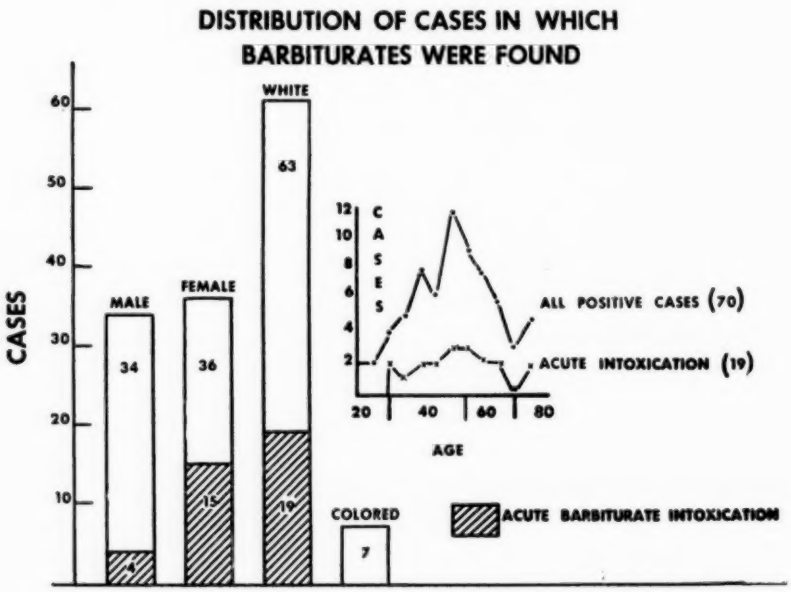

Fig. 3—Distribution of cases in which barbiturates were found. The bar graph indicates the total number of positive barbiturate cases in the respective categories. The cross-sectioned area indicates the number of cases of acute barbiturate intoxication in each category.

It is interesting to note that the age distribution of the positive cases is similar to that of the tested cases with a 15-year displacement of the peak to the younger range. However, in the case of acute barbiturate intoxication, age is not a factor—an average of 2 deaths occurring in each 5-year age group from ages 30 to 79 years.

An analysis of the cases received by the Cuyahoga County Coroner's Office in November 1955 is presented in Table 2. All the suicides and homicides were tested, as were 50% of

the accidental deaths and 70% of the natural deaths. Of those cases not tested, approximately 35% had survived longer than 24 hours under medical supervision. The remainder were not tested because of time limitations. These data are similar to that described for the annual study in Table 1. In the 7 positive cases there are an equal number of men and women and a preponderance of white people. Only one of these cases was a suicide due to acute barbiturate intoxication. In one other suicide, due to carbon monoxide asphyxia, the presence of barbiturates in the deceased may have been a contributory factor. In this one month study only 4% of the total cases were positive.

TABLE 2

DISTRIBUTION OF CASES TESTED FOR BARBITURATES IN NOV. 1955

	MALE		FEMALE		WHITE		COLORED	
	CASES	TESTED	CASES	TESTED	CASES	TESTED	CASES	TESTED
NATURAL DISEASE 183	125	89 (4)	58	45 (1)	146	106 (5)	37	28
ACCIDENTS 49	34	15	15	5	44	16	5	4
SUICIDE 15	7	7	8	8 (2)	15	15 (2)	0	0
HOMICIDE 7	4	3	3	3	1	1	6	5
TOTALS 254	170	114 (4)	84	61 (3)	206	138 (7)	48	37

Cases refer to all cases over 15 years of age seen in the Cuyahoga County Coroner's Office in November 1955. Tested refers to all cases over 15 years of age that were tested for the presence of barbiturates. The numbers in parentheses indicate the number of cases in which barbiturates were found.

Discussion

It is difficult to evaluate these data and dangerous to extrapolate them to other parts of the country. One should compare the finding of 10 deaths due to barbiturates per 10,000 deaths in Cuyahoga County to data from other jurisdictions: 10/10,000 in the State of Maryland, 24/10,000 in New York City, 41/10,000 in Los Angeles County, California, and 60/10,000 in San Francisco. These figures are averages taken from official reports issued by the respective jurisdictions during the periods 1950–1953. Obviously each area has a different incidence of barbiturate intoxication. This incidence seems to be higher the more complex and competitive the social and economic status of the community. On the basis of the data just presented one can only discuss the problem as it pertains to one area.

In Cuyahoga County 10 times as many people died from vehicular accidents as from barbiturate intoxication, 13 times as many died from tuberculosis! Using another frame of reference the following table (3) presents the incidence of ethyl alcohol and of barbiturates in Coroner's cases. The percentages refer to the ratio of the positive cases to the total number of cases tested.

Table 3. Incidence of Ethyl Alcohol and Barbiturates in Coroner's Cases

	Ethyl Alcohol	Barbiturates
Vehicular accident	42%	0
All other accidents	40%	5%
Homicide	69%	3%
Suicide	27%	15%
Natural cause	9%	5%

All these facts seem to indicate that the barbiturates play a relatively minor role as either direct or contributory factors to death.

Another goal of this investigation was to ascertain which cases should be tested routinely for barbiturates in the absence of any information or allegation of ingestion.

The data obtained in the one month study indicated the overall barbiturate incidence to be 4% of the total cases. By extrapolation there should have been 102 positive bar-

biturate cases if all the Coroner's cases (2560) in 1955 had been studied. Actually 70 were found in this study.

In November, barbiturates were found in 5 (4%) of the 134 deaths due to natural causes. The total number of deaths due to natural cause in 1955 was 1842. By extrapolation of the monthly to the yearly data barbiturates might be expected to be present in 73 cases. In this study 35 such cases were detected. The procedure used in selecting the cases probably accounts for this discrepancy. The implication is that 38 additional positive cases might have been detected if all natural deaths were studied. If this total is added to the 70 positive cases found, their sum is of the same order of magnitude as the estimated 4% of the total Coroner's cases.

In the one month study, barbiturates were found in 5% of the combined total of suicidal and accidental deaths exclusive of vehicular fatalities. In the yearly study, barbiturates were found in 6% of these cases.

This study indicates that the incidence of acute barbiturate intoxication in colored people is negligible. While 10% of the positive cases were colored people, the amount of barbiturates found in these cases were well within the therapeutic range. If any group could be arbitrarily excluded from a routine testing program, this one is the most likely.

Since the number of cases in which barbiturates v ere found in homicides and vehicular accidents was so small, it is probable that these cases may be omitted from a general testing program, unless contrary evidence is available.

Of the 70 barbiturate cases 62 were unwitnessed deaths. Thus the original plan of testing only those cases where death occurred unobserved is a reasonable approach to the problem of routine screening for possible barbiturate involvement.

Summary and Conclusions

Barbituric acid derivatives are not as significant a contributory factor in sudden and unexpected death as many reports would have one believe. They do contribute to this problem but only in a relatively minor respect.

In setting up a comprehensive screening program for investigating unsuspected barbiturate intoxication, one should include those cases of natural death where death was unwitnessed, all suicides and all deaths due to accidents other than vehicular. Colored people could reasonably be excluded

from the survey. These data pertain to Cuyahoga County. Extrapolation to other areas may not be valid.

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Cuyahoga County Coroner's Office and the
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Tetraodon (Blowfish) Poisoning

A Report of Two Fatalities

Jerome Benson, M.D., Miami Beach, Fla.*

The problem of human morbidity and mortality related to the ingestion of certain species of fish has been brought to sharp focus in view of the ever increasing popularity of sport fishing in the tropical waters of this country. The unwary amateur, unacquainted with the toxic potential of certain species of fish, may unknowingly eat a portion of the viscera or contaminated flesh of these fish, and thus become severely ill or die from the effects of a virulent toxin.

Species of the fish family Tetraodontidae live in the coral reef areas of warm seas and, occasionally, in temperate seas. They are found in the tropical coastal waters of the Western Hemisphere, and in the tropical seas of the Pacific Ocean, from California to the Japanese coast. The viscera, roe and, occasionally, the flesh of these fish are extremely toxic. Their usually nontoxic flesh may be rendered toxic through careless cleaning, especially from contamination with bile (1). These species have many vernacular names, including blowfish, puffer, swellfish, rabbitfish, swelltoad, toadfish, blower, jugfish, fugu (Japan), tambores (Cuba), etc. (2). They take large quantities of air or water into their stomach when they are threatened, or when they are "tickled" on the ventral aspect, thus assuming an enlarged, globular shape, making it less likely for them to be swallowed by a predator. The smooth or somewhat prickly skin is partially covered by bristly or hair-like spines. The mouth is small and shows a characteristic dental configuration (Fig. 1).

Clinically, the effects of Tetraodon poisoning are the same, regardless of species. There is numbness, and/or itching of

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the mouth, hands, feet and anal region. Nausea and vomiting occur, associated with inability to swallow, loss of hearing, and paralysis of respiration and voluntary muscles. Circulatory collapse may occur, followed by convulsions, delirium, and death. The latter may supervene less than one, or up to 20–24 hours after ingestion of the fish. Treatment is usually in the form of induced emesis, gastric lavage with tannic acid, and administration of atropine by hypodermic. Calcium gluconate has been said to relieve muscular cramps that may occur (1).

A case of blowfish poisoning was reported in the South Florida area in 1951. This concerned an elderly man who died shortly after eating the liver of "toadfish." His wife and daughter were also affected, but survived (1). There is no further information available.

The following two autopsied cases of blowfish poisoning occurred in the South Florida area during the past two years. They are reported because of their unusual toxicological and medico-legal aspects. A report from the Florida State Board of Health reveals no other reported cases (6).

Case Reports

Case 1. A 65-year-old white female tourist in South Florida ate the liver of the puffer, *Sphoeroides testudineus,* the West Indian swellfish which abounds in Florida coastal waters. The identity of the fish was verified at the Marine Laboratory of the University of Miami and the Miami Seaquarium, after inspection of the remains of the frozen meat of the incriminated fish, and interview of the fisherman, a neighbor, who gave a perfect description of the fish in question. Within five minutes after the deceased ate the cooked liver, she complained of a tingling numbness of the inside of the mouth and throat, an inability to swallow, and numbness of the fingertips. This was followed by marked nausea and vomiting, and by circulatory collapse as manifested by sweating, paleness and prostration. She arrived in the hospital Emergency Room with unobtainable blood pressure. She was pulseless and had rapid, shallow respirations. She was unable to speak, and had marked dyspnea. In a few minutes after her arrival at the hospital, or 45 minutes after the ingestion of the cooked liver of the puffer, she expired. Autopsy

revealed no remarkable gross anatomical features, except for marked cloudy swelling and friability of the liver. Toxicological reports from the Florida State Laboratories were negative for alkaloids, heavy metals, cyanide, ethyl and methyl alcohol, and barbiturates. Microscopic examination of the tissues revealed cloudy swelling and acute congestion of the lungs, liver, spleen and kidney. There was moderate chromatolysis of the ganglion cells of the medulla.

In view of the positive identification of the species and the correlation of the type of death with the history of ingestion of the fish liver, it was felt that there was strong evidence for the relationship of the ingestion of puffer liver and the death of the individual.

Case 2. A 53-year-old male teacher in a local elementary school complained of nausea and vomiting within a few minutes after eating the flesh of a blowfish. He had previously eaten this flesh on many occasions without incident. The possibility of contamination of the flesh by improper cleaning was admitted by the patient during questioning in a local hospital Emergency Room. Requesting transfer to a local Veterans' Hospital, he was placed in an ambulance, and upon arrival at that facility, complained of pressure in the chest, associated with numbness and paralysis of the extremities. Upon arrival at the hospital, he suddenly expired, six hours after ingestion of the fish. No remains of the blowfish which the patient had eaten were available for examination, and no one had shared his meal. Autopsy revealed acute congestion of the lungs, spleen and kidneys, with pulmonary edema, and mild, fatty metamorphosis of the liver. Toxicological studies of autopsy material for metallic and volatile and nonvolatile organic poisons were all negative, except for a general test for alkaloids with Mayer's reagent. Color tests for specific alkaloids with Buckingham's, Frohdes', Marquis', and Wasicky's reagents were negative. Extracts of gastric contents, urine, and liver-kidney mixture were administered to mice intraperitoneally. The extracts had been filtered through glass wool and then through #40 filter paper. Gastric contents were diluted 1:1 with water. Urine was used undiluted. The liver-kidney mixture was homogenized in a Waring Blender, together with the juices sent with the tissue. Two ml. of water were added per gram of tissue. Liver-kidney

mixture #1 was injected, untreated; liver-kidney mixture #2 contained one drop of HCL per 25 ml. The results are summarized in the accompanying table.

Discussion

The nature of the toxin in blowfish poisoning is not as clearly understood as that from shellfish poisoning, in which bacteria and dinoflagellates have been incriminated as the cause (1). Since Tetraodon poisoning has been a major cause of food poisoning in Japan (accounting for 44% of the total cases of food poisoning in the period 1927–1937, for example), the Japanese have made extensive studies of what they call "tetraodontoxin." The results of these studies are not conclusive. Tetraodontoxin has been isolated as a white hygroscopic powder, insoluble in ordinary organic solvents, and very readily soluble in water. It has a provisional chemical formula assigned as $C_{16}H_{31}NO_{16}$. This substance does not give any of the protein reactions, nor is it precipitated by alkaloidal reagents. The possibility that it is a protamine derivative has been entirely excluded. The lethal dose is a 4 mg./kg. of body weight (3). The source of the toxin is unknown. Although it has been compared to muscarine pharmacologically, the fact that there is an overall mortality rate of 60%, even with the best of medical care, including the use of atropine, indicates that the exact nature of Tetraodon poisoning is still obscure (1). As observed by Halstead, the toxin is not affected by the heat used in a commercial type canning process (2). In Case 1, the cooking of the liver had no apparent effect on the toxin. As noted by the Japanese, the toxin is water soluble, and can be removed from possible contaminated fish flesh by thorough soaking of the flesh in water. This process, however, makes the flesh much less palatable.

The question as to the similarity of the toxin of the Japanese puffers to that of the Western Hemisphere species is unanswered. Clinically, the effects are very similar. However, it is of interest to note that while the Japanese have indicated that tetraodontoxin is not alkaloid in nature, the tissue extracts in Case 2 gave a positive general alkaloidal reaction with Mayer's reagent, but no specific reaction with other alkaloidal testing reagents.

A comparison of the number of cases of Tetraodon poisoning in Japan with those in this country, reveals a remarkably

higher incidence in the former (4, 5, 6). This may be explained on the basis of the general avoidance by Occidentals of the use of certain fish and/or their viscera for food, for various religious, ethnic, esthetic, and economic reasons.

From the standpoint of general information, the U. S. Air Force Information Bulletin No. 11 (1944), summarizes the identifying features of poisonous fish as follows:

"1. No poisonous fish has ordinary scales such as we see on bass, snapper or goldfish. Most of the poisonous fish are covered with rough or spiny scales, with thorn-like spines, or with long plates. One group of poisonous fish has skin devoid of scales, but is covered with soft spines or bristles, which in some cases may look like hair.

"2. The jaws of most of the poisonous fishes have an enamel-like covering without distinct teeth. This forms a powerful, gleaming white, turtle-like beak.

"3. Few of these poisonous fishes have regular fish shapes; instead, they are grotesque creatures with box-like bodies or other bizarre shapes."

In view of the type of death resulting from the ingestion of the viscera and/or contaminated flesh of the puffer, and the fact that the exact nature of the toxin is unknown, it behooves the investigator of such cases to obtain a careful history, to try to have the incriminated fish identified, to rule out other forms of intoxication, and to study the effects of the toxin extracted from tissue obtained at autopsy, as noted in Case 2. Certainly there is a need for further investigation of the chemical nature of the toxin and the therapeutic aspects involved.

Summary

Two cases of fatal Tetraodon (blowfish) poisoning in Southern Florida are reported. In one, the cooked liver of the West Indian Swellfish, or Puffer, was ingested. Death occurred in less than one hour, after characteristic symptoms developed. In the second case, the flesh of the Puffer was ingested, followed by similar symptoms, and death in about 6 hours. Present information concerning the chemical and pharmacological nature of the toxin is incomplete, despite extensive investigation, especially by Japanese authorities. There is no known antidote for the toxin. The liver, intestine,

roe, and gonads are known to be violently toxic for humans. The flesh is variably toxic, depending on the species and the

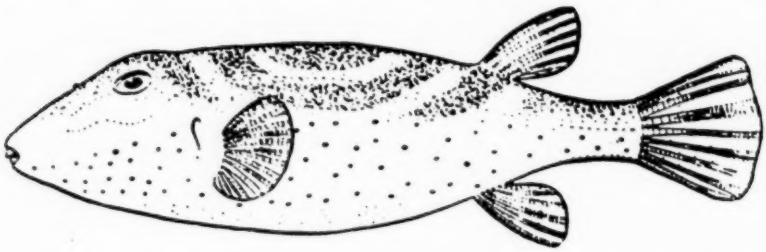

Fig. 1—Puffer, or Swellfish, *Sphoeroides testudineus* (Linnaeus). (Drawn by Mr. Craig Phillips, Curator of the Miami Seaquarium. Courtesy of the Marine Laboratory, University of Miami, Coral Gables, Fla.)

EFFECT OF BLOWFISH TOXIN ON MICE (Case 2)

METHOD	SOLUTION #1	SOLUTION #2
Gastric Contents of Deceased Injected I. P. (1 ml.)		
MOUSE 1	Death in five minutes.	Death in two minutes.
MOUSE 2	Death in five minutes.	Death in two minutes.
Gastric Contents of Normal Person Injected I. P. (1 ml.)		
MOUSE 1	Alive and active in 48 hours.	Alive and active in 48 hours.
MOUSE 2	Alive and active in 48 hours.	Alive and active in 48 hours.
Urine of Deceased Injected I. P. (3 ml.)		
MOUSE 1	Death in 20 hours, after short period of respiratory difficulty.	
MOUSE 2		Death in 20 hours, after short period of respiratory difficulty.
Liver and Kidney of Deceased Injected I. P. (3 ml.)		
MOUSE 1	Death in 21¾ hours.	
MOUSE 2		Death in 20 hours.

method of cleaning the fish. A 60% mortality rate has been reported in these cases, even with the best of medical care.

The author is grateful to Mr. Don de Sylva of the Marine Laboratory, University of Miami, Coral Gables, Fla., and to Mr. Craig Phillips, Curator of the Miami Seaquarium, Key Biscayne, Fla., for their assistance in the preparation of this paper.

Judge Kenneth E. Oka, Justice of the Peace, 5th District, Dade County, Fla., kindly permitted the release of information concerning Case 1. Data on Case 2 was obtained by kind permission of the Clinical Laboratories, Veterans' Administration Hospital, Coral Gables, Fla.

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4300 Alton Road
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The Human Dentition in Forensic Medicine

N. Y. Meeting, A.A.A.S., 1956 Christmas Meeting
W. M. Krogman, Philadelphia, Pa., Presiding

Tentative Program

1. Criteria of ageing in the teeth and identification of fragmentary teeth, David Scott, U.S.P.H.S., Dental Division.
2. Time and sequence of tooth eruption. V. O. Hurme. Forsythe Dental Infirmary for Children. Boston.
3. Calcification of the teeth. Isaac Schour and Maury Massler, U. of I. Dental School.
4. Criteria of individuality in the teeth. A. A. Dahlberg, Chicago.
5. A survey of racial traits in the human dentition. Gabriel Lasker, Wayne U., Detroit.
6. The genetics of the human dentition. B. S. Kraus, U. of Arizona, Tucson.
7. Roentgenographic appraisal of cephalo-facio-dental individuality. Viken Sassouni, U. of Pa., Philadelphia.

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Book Reviews

PATHOLOGY, by Peter A. Herbut, M.D., Professor of Pathology, Jefferson Medical College and Director of Clinical Laboratories, Jefferson Medical College Hospital, Philadelphia. Lea and Febiger, Philadelphia, 1955. 1227 pages with 1378 illustrations. Cloth $16.00.

This book is based upon the author's didactic pathologic lectures given at the Jefferson Medical College in Philadelphia and the various exercises in pathologic anatomy gross and microscopic in actual classroom use. It is obvious that the author's intentions were to review the subject of pathology for the undergraduate and postgraduate student of medicine in a concise and well-organized manner. Throughout the entire text there is a uniformity of presentation of the material. Each subject discussed is divided into five categories: 1. Congenital anomaly, 2. Degeneration, 3. Inflammations, 4. Physical Disturbances, 5. Tumors. In each paragraph the important objective is indicated by italics and directed to the reader's attention. At the end of each chapter is a fairly complete bibliography.

The author not only directs attention to the essentials, and in his judgment, the most important pathologic changes that occur, but includes the clinical findings and often suggests therapy. This detailed review of a disease process, including therapeutic recommendations, may be questioned by some because it is believed that there are multiple ramifications in the clinical and therapeutic regimen of a disease entity that may be confined to areas other than a textbook on pathology. The author has had considerable experience in the integration of the clinic and the laboratory. He has published books on urologic pathology, surgical pathology, and gynecologic and obstetric pathology, and in this manner is called upon by the clinician to suggest various forms of therapy as well as diagnostic procedures. This type of information should be made available to the student. The pedantic approach to the study of pathology, where much emphasis is placed on

detailed histologic structure without correlating the gross and microscopic findings with the clinical history and therapeutic management, may be a void in the total understanding of the various exercises the student encounters in the laboratory. There are forty chapters discussed in the text, and the one on the central nervous system is written by a neuropathologist (Dr. B. J. Alpers). The reader's attention is also directed to the origin and the root of terms used in medicine and in pathology.

An interesting phase of the subject of pathology which should be of importance to the student and physician is a chapter on the autopsy with a comment on the medical-legal necropsy. Whenever possible a discussion of trauma in relationship to disease processes is briefly reviewed.

This text represents a general dissertation on both medical and surgical diseases and to point out in succinct fashion the most essential gross and microscopic findings for each of the subjects discussed. The type is clear. The book is profusely illustrated and the publishers deserve special commendation for the excellent photographs, gross and microscopic. It is obvious that the student and physicians will find this book of valuable assistance to him in his study of pathology and its correlation with the clinic and the laboratory. From its introduction through its adequate bibliography and fine index this text is a welcome addition to the growing list of books dealing with pathologic anatomy.

THE DOCTOR IN PERSONAL INJURY CASES, by Harold A. Liebenson, Esq., of the Chicago Bar. The Year Book Publishers, Inc., Chicago, Illinois, 1956. 118 pages.

The most damning thing that can be said about this short (118 pages) but very practical discussion of how the physician aids in the administration of justice in law suits involving a personal injury is to suggest that a more fitting title would be "The Plaintiff's Doctor in Personal Injury Cases." The real, though not specifically stated, purpose of the book seems to be to instruct physicians in how to prepare a medical report for their patients which will be most apt to result in a successful law suit or a more advantageous settlement. There is an underlying feeling that physicians who testify as experts for defendants, especially for insurance companies, are more likely to trifle a bit with the truth than are the plaintiff's

witnesses. Aside from this shortcoming, which, in all honesty, is not as prominent in the book as it is in this review, the book has a lot to offer to the physician who is an unfamiliar, and perhaps unwilling, participant in the trial of a law suit. It spells out in a very practical manner the importance of good medical reports and good medical testimony. In emphasizing the medical report, it outlines the features which such report should contain and gives examples of both good and bad reports. It discusses some of the problems a physician will face on his direct examination and a few of the hazards he must overcome on cross-examination. The book can be read from cover to cover in a few hours, and it should be read by all physicians. There is a good index and a rather complete glossary of terms which the witness should understand. This book will furnish aid and comfort to the uninitiated and a number of good pointers to the experienced medical witness.

CLINICAL LABORATORY DIAGNOSIS, by Samuel A. Levinson, M.D., Ph.D., Professor of Pathology, University of Illinois College of Medicine and Director of Laboratories, University of Illinois Research and Educational Hospitals, and Robert P. MacFate, Ch.E., Ph.D., Chief, Division of Laboratories, Board of Health Chicago, Director of Laboratories, Municipal Contagious Disease Hospital, Chicago, Ill. Lea and Febiger, 1956. 5th Edition. 1246 pages. $12.50.

The fifth edition of this standard and highly regarded work brings together the important data relative to laboratory diagnosis. The authors have exercised acumen in selecting what in their judgment represents the most useful methods in laboratory medicine. The result is a highly informative book that gives an intelligent and authoritative appreciation of the basic sciences to clinical medicine.

The fifth edition is increased by 100 pages over the fourth edition. There are twenty chapters in the text, some revised and brought up to date, others completely rewritten. Beginning with diseases of the mouth and gastrointestinal tract, this is followed by a discussion on diseases of metabolism, chemical analysis of the blood and urine, and the kidneys. The section on Hematology written by Drs. Louis, Best, and Limarzi with a discussion on blood bank procedures by Dr. Wolf, has been completely rewritten and is a most valuable and informative addition to the text. Chapters on immunology, serology, cerebrospinal fluid, transudates and exudates,

sputum, skin tests and other biologic examinations have been revised and brought up to date. The chapter on bacteriology, revised by Miss Turner, presents a practical approach in the identification, isolation, and sensitivity tests for the antibiotics which is a valuable tool for the technologist in the laboratory as well as an aid to the practicing physician.

The authors have transferred the discussion on hematology from the section on Laboratory Methods in Pediatric Procedures to the section on Hematology but the remainder of the laboratory procedures in Pediatrics is adequate and helpful for the pediatrician. Chapters on Tropical Medicine, revised by Dr. Hood; Milk and Water Analysis, and histologic technic have been revised and new material added. The chapter on Legal Medicine by Dr. C. Muehlberger is an excellent one. It has been rewritten and contains the pertinent procedures and discussion of tests that can be performed in a well equipped hospital laboratory.

New items have been added to the fifth edition, such as micro-chemical methods, a discussion on electrolyte balance studies, 17 Ketosteroids, VDRL method in serology, electrophoresis studies, clinical hemoglobinometry, spectrum analysis of hemoglobin derivates, et cetera. The authors have retained a detailed step-by-step method wherever chemical, urine, and toxicologic examinations are discussed.

The text is profusely illustrated with colored and black and white reproductions. The table of contents and index (of 37 pages) are very adequate. The publishers are to be complimented for excellent type, good reproductions, and craftsmanship.

If the primary duty of the book critic is to determine how well the authors have accomplished their objective, the reviewer must acknowledge that their purpose should serve well all persons interested in clinical laboratory diagnosis. This fifth edition can be recommended as a positive utility for medical students, medical technologists, pathologists, and practicing physicians, and should be in the working library of every clinical laboratory.

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